FEB 1 1912
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American Machinist

Volume 36, No. 5.
Issued Every Thursday.
Hill Publishing Company.

NEW YORK, FEBRUARY 1, 1912.

Price, 15 Cents.
Reading Index, 233.
Advertising Indexes, 33.

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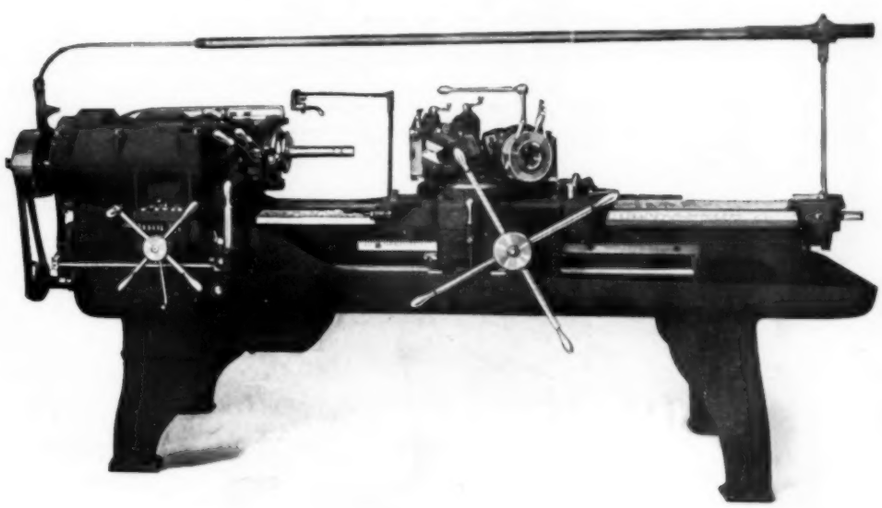

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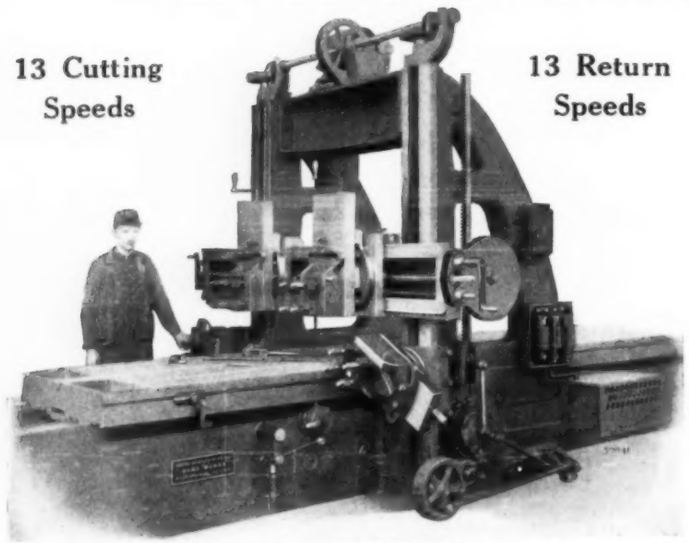
The First Successful Variable Speed Planer

13 Cutting Speeds

13 Return Speeds



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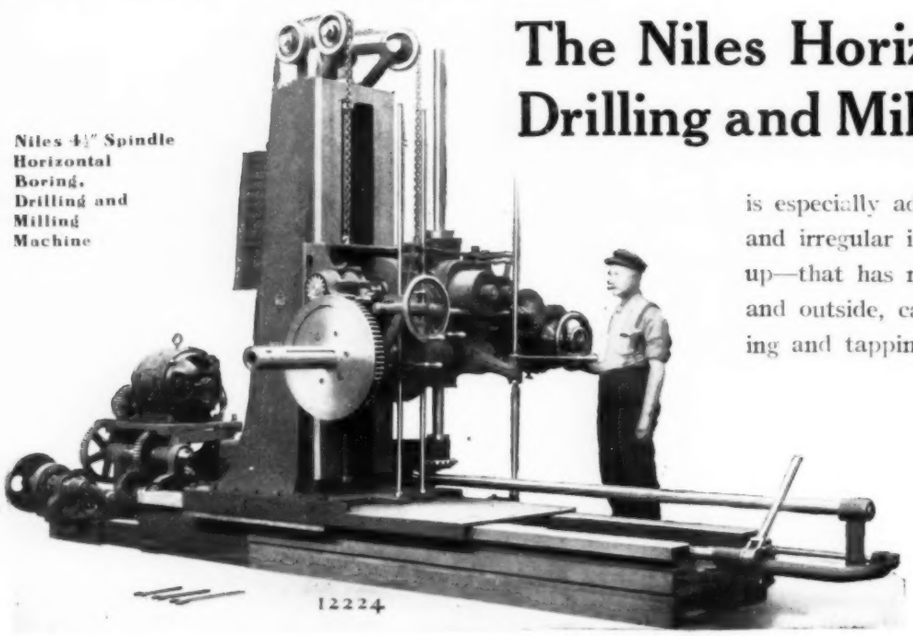

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An Innovation in Turret Design

Editorial Correspondence

Method of design, construction, and tests of a new turret built by the Bullard Machine Tool Co.

The design was developed from a written analysis of the old-style turret, prepared in a way topoint out possible improvements

A departure in turret design has been brought out by the Bullard Machine Tool Co., of Bridgeport, Conn., and applied to their vertical and turret lathes. In addition to the novelty of its construction and ease of operation, the method by which it was designed is of especial interest; namely, from a written analysis. This method deserves to be more widely used.

The new turret is illustrated in Figs. 1 and 2, in the first in a locked position, in the second unlocked.

Before beginning the layout for this design E. P. Bullard, Jr., prepared a written analysis, arranged in three parallel columns, giving the elements of the mechanism and operation of the turret they were then building, the result or effect of using that mechanism in the manner intended, and the remedies for the features that might be improved upon.

The Written Analysis

This analysis is reproduced in Table 1.

The function of a turret is to hold tools set for successive operations so that they can be quickly and accurately brought into operating position. Exact register is of prime importance. This demands accurate indexing and rigid locking devices, a convenient and sensitive control, means to insure permanence of alignment, and provision for restoring accuracy should it be impaired in use.

An examination of the older type of turret made by the Bullard company shows (see Table 1) that it had a spring-engaged lock pin, a hardened index ring, a rigid center stud, and means for binding the turret positively to its slide. At first thought there might seem to be little room for improvement.

Analysis, however, shows that the lock pin being a sliding member and performing a double function—indexing and locking—may offer opportunity for error. The spring is a variable and may or may not seat the pin exactly alike at all times. The center stud is straight and must be a running fit in its bearing hole in the turret, thus introducing a joint that has some freedom. If wear takes place between the turret and its seat the alignment will be destroyed. The shock of stopping the revolving turret, particularly when eccentrically loaded with tools, tends to damage both the lock pin and index ring.

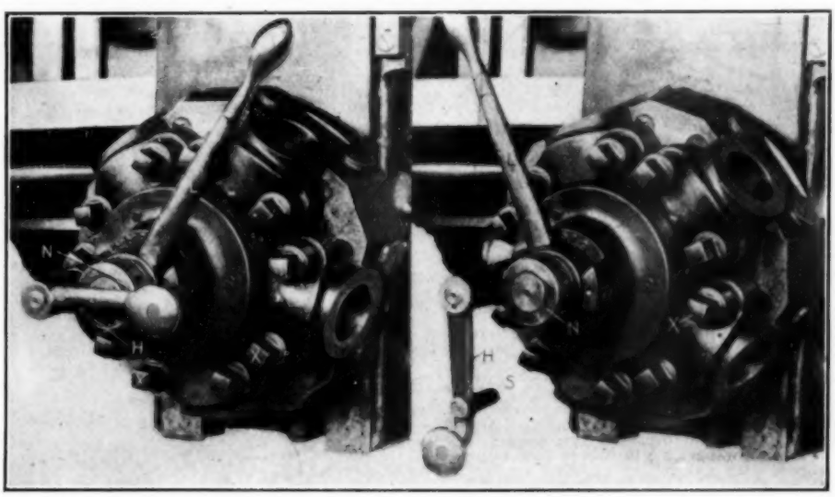

Fig. 1 Fig. 2

New Five-hole Turret in Locked and Unlocked Positions

Features of the New Turret

Details of a new five-hole turret are shown in Figs. 3, 4 and 5.

The functions of indexing and registering have been divided. In the back of the turret is a projecting pin with a rounded end, *B* in Figs. 3, 4 and 5, and five corresponding holes in the turret slide, one for each turret position. The holes are best seen in the right-hand view of Fig. 5. This pin and these holes do the indexing.

Turning again to Figs. 3, 4 and 5, ten pins *A* are shown arranged in pairs and projecting from the back of the turret. These are the turret registering pins, one pair serving for each turret position. In the face of the turret slide and at the top (see the right-hand view of Fig. 5) are two similar pins arranged to mate, as desired, with each pair of pins in the turret. These six pairs of pins do the registering.

They are milled to give inclined contact faces as shown in the section of Fig. 3. They are not hardened as no wear is anticipated. They are a snug fit in their holes and are backed up and adjusted by fine-threaded screws. The screw heads are sunk below the front face of the turret and the resulting recesses are filled with smooth plugs to make it difficult to reach the screws for adjustment. Experience has proved that adjustment is seldom necessary. From the arrangement of these registering pins it is obvious that any one pair can be adjusted without disturbing the others. Thus a correction can be made for one turret hole should any inaccuracy creep into its registering without affecting the other holes.

The indexing pin projects a short distance beyond the registering pins. In the operation of indexing the turret is withdrawn about ⅛ of an inch from its seat, thus clearing the index ring, index pin and registering pins. When a new position is reached the index pin must enter its hole in the turret slide before the registering pins can come into contact. Thus the registering pins come into gradual contact on their inclined faces as the turret is locked and hold it against side motion. They can come into contact in no other way. This is the means provided to minimize the wear on the registering parts.

The stud in the turret slide is slightly tapered and when the turret is seated this stud is a binding fit in its mating hole. When the turret is pulled forward to index this fit is freed. There is ample clearance to revolve the turret, yet when locked there is no freedom between turret and stud. Further there is no wear on this tapered fit other than that caused by the action of pulling the turret on and off. Still further there is no contact, consequently no wear, between the index ring and its seat when the turret revolves.

A ring at the base of the turret, Fig. 4, excludes dust when the turret is drawn forward.

The muscular effort needed to revolve a large turret filled with heavy tools, many of them projecting a considerable distance is readily appreciated. To reduce this effort a handle *H*, Fig. 4, is

provided. The turret is revolved by means of an internal gear *G* meshing with a pinion *I* fixed to the stud of this handle. The gear ratio is 5:1. This

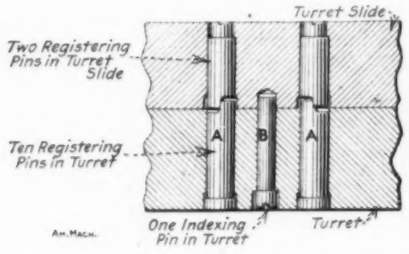

FIG. 3. SECTION SHOWING LOCKING PINS IN TURRET

gives considerable mechanical advantage and allows the operator to have the turret always under control. One revolu-

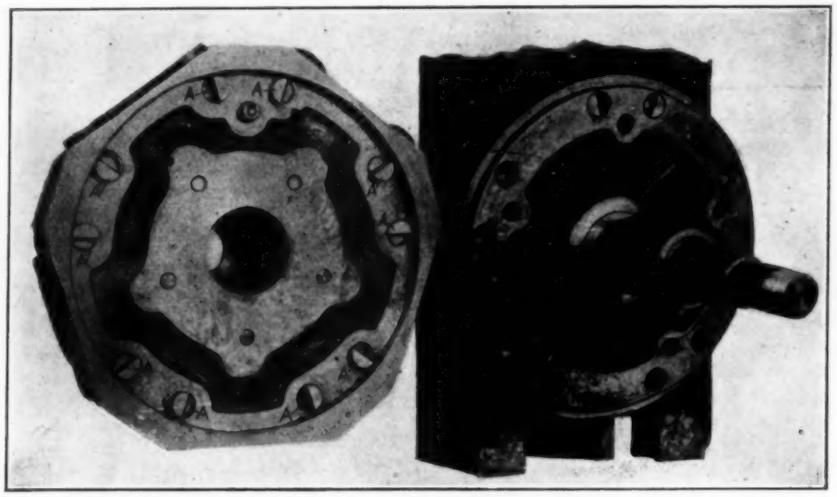

FIG. 5. TURRET AND SLIDE SHOWING INDEXING AND REGISTERING PINS

Mechanism and Operation of Old Style Turret	Results in Use	Remedy
Turret revolves on seat.	Turret wears back and alignment with center is destroyed.	Raise turret from seat before revolving.
Turret revolves on straight center stud. Customary clearance for running fit about 0.00125 inch.	Necessary original clearance caused error in registration of tool as pressure was applied on one side or the other under working conditions. Conditions grow worse as turret is used due to wear of hole and stud, also peening action of cut.	Use taper stud on which turret fits absolutely when forced back to its seat. Stud should have sufficient taper to permit of free revolution of turret when it is away from its seat.
Lock pin must be free in guide to permit of engagement and disengagement.	Freedom allowed for sliding fit presents the same difficulties as described above. Gib on side takes up wear in one direction only and will eventually throw faces out of alignment. Gib on both sides increases number of parts subject to wear and looseness.	Locking or registry pins must be rigidly and immovably secured in both slide and turret respectively.
Single lock pin for all faces of turret.	Any adjustment for one face of turret is reflected in all other faces of turret.	Registry pins for each face must be individually adjustable when required, but so constructed as to eliminate the possibility of wilful tampering with the original adjustment.
Lock pin is spring controlled.	Springs vary in strength according to material and temper; are subject to breakage. Effective engagement of lock pin in indexing ring varies with pressure of spring and adjustment of gibs. Pin rebounds from its seat in ring when shot into place by spring action. Full seating of pin in ring not invariably obtained.	Fixed registry pins eliminate the requirement of spring action.
Hardened index ring.	Ring must be drilled for securing screws and dowels before hardening with resultant warped holes, to which dowels cannot properly be fitted. Rings, therefore, become loose under action of cut and careless engagement of lock pin therewith; alignment of turret faces soon becomes destroyed. Both index ring and lock pin are subject to serious abuse, as the lock pin is engaged with great force when turret is indexed, no device being provided to insure even approximate indexing before engagement. Correction of error in alignment due to wear in index slots is extremely difficult even if possible.	Provide means of indexing turret before engagement of registry pins if possible, thus avoiding injury to them.
Turret revolved by taking hold of tools.	Unless tools in turret are placed in balance this operation presents possibility of danger to the operator.	Provide mechanical means of revolving turret, to have sufficient power to absolutely control turret movement regardless of position or weight of tools.
Holes in turret bored into turret body itself.	Holes are subject to wear in the mounting of boring bars, tool holders, etc., and unless a perfect fit is maintained the hole is gradually peened out of shape by vibration and alignment is destroyed. An entire new turret is required to correct the error in even one hole.	Bush turret holes with hardened sleeves readily removable without injury of original hole, thus permitting easy repair of turret holes.
Binder plugs on only one side of hole.	Even with floating differential binder plugs there is a tendency to crowd the shanks of bars to one side—thus destroying the hole.	Binding pressure should be equal over entire surface of the shank of bar or tool holder. Spring bushings and box cap will compensate for slight wear in bushing or shank or a variation in sizes of shanks.

TABLE 1. ANALYSIS OF OLD STYLE TURRET, RESULTS FROM ITS USE, AND REMEDIES TO BRING ABOUT IMPROVEMENT

tion of the handle *H* corresponds with a movement of the turret from one hole to the next.

On this handle is a boss containing a spring-controlled feeler pin *S* to aid in quickly entering the indexing pin in any desired hole in the turret slide. This pin *S* enters a small spot as shown, when the index pin *B* is in position to enter one of its mating holes. Thus if the feeler pin is brought into position to enter its spot, the turret is in position for the index pin to find one of its seats and for the turret to be locked.

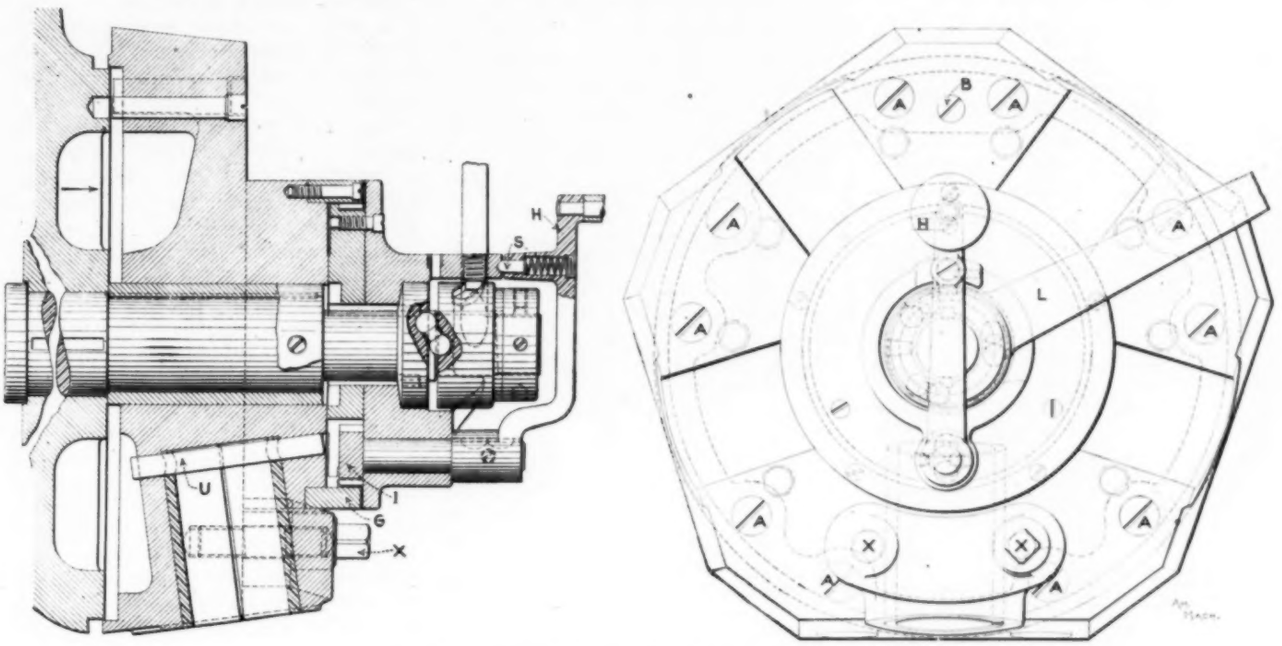

FIG. 4. SECTION AND FRONT VIEW OF TURRET

The locking and unlocking of the turret is done by the lever *L*. Its hub has a curved slot in which is entered a pin fixed in the front member of the turret, see Fig. 4. Between the hub of the lever and a washer fitted to a spherical seat in this same member are three short toggle pins. In the unlocking movement the lever *L* pulls the turret forward by the action of the cam slot and its mating pin. The reverse motion pushes the turret back and the final locking is done by the action of the toggle pins. These are hardened, and fit into hardened seats in the lever hub and washer. Adjustment of the lever *L* is obtained by the collar *N* which is separated from the lever hub by a hardened-steel washer.

THE BORING BAR DRIVE

A new form of drive for boring bars, reamers and similar tools when held in the turret holes is shown at *U* in Fig. 4. This consists of a hardened-steel pin located at the bottom of the turret hole. It is in reality putting the tang in the sleeve instead of on the shank of the tool.

The tool shank is correspondingly slotted and is clamped in place by the cap nuts *X*.

The turret holes are bushed with hardened-steel bushings for the purposes of maintaining size and ease of renewal when necessary.

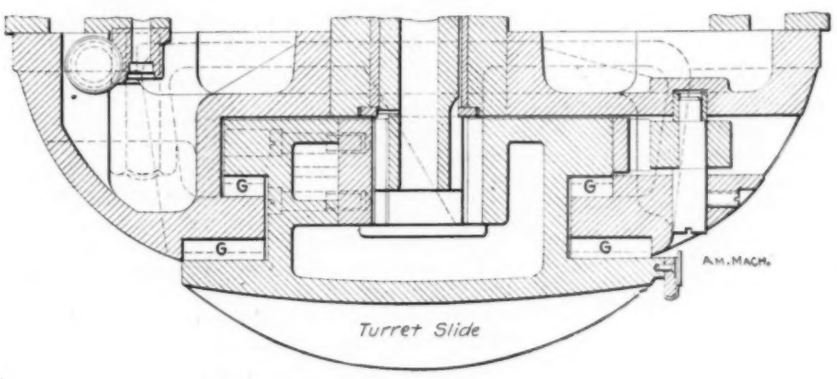

FIG. 6. CROSS-SECTION OF SLIDE AND SADDLE

GIBBING THE TURRET SLIDE

The method of guiding the turret slide and maintaining its alignment has been modified as shown in Fig. 6. Two tapered gibs are used on each side of the slide, presenting steel bearing surfaces to resist pressure and wear and to permit of accurate realignment at any time. The four gibs are as shown at *G*. Here it will be seen that they have been brought forward nearer the turret. This change greatly increases the base of the triangle drawn from the center of the turret hole through the supporting gibs, thus adding to stability by increasing the resistance to the twisting stresses from boring bars and other tools in use.

COMPARISON OF ANALYSIS AND MECHANISM

It is worth a moment's time to turn back to Table 1 and compare the items under the heading "Remedy" with the mechanism shown in the illustration. It is seen that the turret details as finally worked out, fulfill the requirements of the "Remedy." This is a striking proof of the value of a written analysis in developing a design. It is the recording of the steps and conclusions of clear thinking, and such thinking must always precede successful design.

The striking change between the mechanisms of the old and new turrets lies in the subdivision of functions. For a single example, the old lock pin both indexed and registered. It performed two functions. In the new design there is one indexing pin and mating pairs of registering pins—a subdivision of functions.

Simplification of design begins with this subdivision of functions. Nine times

out of ten such subdivision is a decided improvement.

Tests for the Accuracy of the Indexing

The proof of a pudding is in the eating. One proof of the success of the design of a turret is the accuracy of its indexing. Such tests have been applied, using the method illustrated in Fig. 7.

An American Watch Tool Company's indicator having a 2¾-inch dial graduated to read thousandths of an inch was set up to come in contact with a bar extending 20 in. from the face of one of these turrets. The distance from the center of the turret to the point of contact was 27⅛ in. Tests were made by placing the bar in each hole of the turret, indexing it ·enty times for each position and reading the indicator, which was set at zero for the first test of each face. Several men operated the turret during the test to get varying conditions of operation.

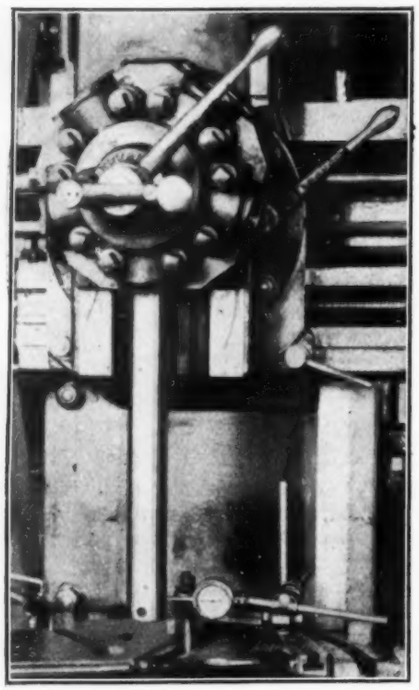

Fig. 7. Set-up to Test Accuracy of Indexing

Table 2 is the record of three tests made on a turret applied to a 36-in. vertical turret lathe. The first test was made on Oct. 2, 1909; the second on July 2, 1910, after an elapsed period of nine months. The third test was made on Jan. 11, 1912, after an elapsed period from the first test of twenty-seven months. During this time the turret had been constantly in use in the shop of the Bullard company, being operated by both men and boys on the regular run of machine-shop work.

Date	Test	Face	Maximum variation from zero on indicator in thousandths of one inch
Oct. 2, 1909	1	1	0.00000
		2	0.00025
		3	0.00000
		4	0.00025
		5	0.00000
July 2, 1910	2	1	0.00050
		2	0.00050
		3	0.00000
		4	0.00000
		5	0.00025
Jan. 11, 1912	3	1	0.00025
		2	0.00000
		3	0.00050
		4	0.00025
		5	0.00000

TABLE 2. RECORD OF THE INDEXING TESTS ON A FIVE-HOLE TURRET

The test of Jan. 11, 1912, was made after the turret had been removed for inspection by the writer of this article. The variation noted in the record occurred in the second or third indexing of each face and was identical for every subsequent indexing. As the indicator was set at zero for the first test of each face, it may be assumed that in replacing the turret after the inspection referred to there was some accumulation of oil or dust that had not been removed from the registering pins and was the cause of the variation noted.

To forestall possible objection to the readings given in the record of the tests, that is, to quarter thousandths, it should be stated that the spacing of the graduations of the test indicator is quite a little less than $\frac{1}{16}$ of an inch. Thus the exact reading to a quarter thousandth may be more a matter of opinion than fact. However, the variations in themselves are so small that even should they be only one-half of the real variations the accuracy of the indexing would still be noteworthy.

Apprentices Past and Present

By J. G. Dornbirer

About 25 to 30 years ago, good machinists were produced as follows: A boy 16 or 18 years of age was attracted to this most interesting occupation, primarily because he was interested in machinery, and also because he felt he must have a means of making a living. If he got a chance to learn the trade he was proud of it, and nine cases out of ten, made good. There was no necessity for laying all sorts of bait to make him feel that he was embarking in the greatest field for mental activity that the work had to offer—he knew it. He was just glad to go in and get what was handed out, and the courses were about in this order:

The Old Apprentice Curriculum

The first three months sweep the shop, oil the shafting and loose pulleys, keep up the fires in winter and lend a hand wherever needed. The next six months, help in the foundry, in the engine room, in the blacksmith shop, and on a driller. Then he spent a year on a lathe, where he learned to do fast, rather than good work, because as the boss often said: "You must learn to get a move on before your bones are hard; you can always learn to improve the quality." After this he had six months on the planer and shaper.

Now, here the order was to learn to set up the work quick, true and without springing it, if possible. Most anyone could do the rest. The next year was spent as a floor and vise hand, a part few boys care to learn, but which, however, requires a greater amount of skill than any other branch of the trade. The fourth year he usually took the place, temporarily, of those absent, and ran such other machines as were at hand, made repairs on tools and machines in the shop, etc. I have never talked with a mechanic of the old school, who did not think that the happiest part of his life, from beginning to the end, was his apprenticeship.

The question often arises: Which method makes the most efficient machinist? As some of the large shops make them now, or as they used to be instructed? This question is not asked to invite a discussion, since individual shop conditions will decide the question in the mind of every foreman. The first three months, as stated above, look like a waste of time, but careful observation will show that more is learned during this period than any other of the same duration in the whole remainder of the active life of a machinist. The apprentice who reads his trade literature becomes a machinist, and he who doesn't becomes a machine. The machine, with all its mechanical refinements, to him will always remain a machine, having no power to do anything but that which its design embodies.

Specialization Not Desirable

Admitting that we are always progressing, some of us are, nevertheless, frequently confronted with the question whether progression is sometimes nothing but disgression. Specialization in manufacturing is good, but to specialize or direct the mind to become an expert in one thing, certainly is not to be recommended in a field in which that specialization means little to the individual and practically nothing in general. The methods in use to produce good, efficient machinists 30 years ago, and the methods in vogue now, together with the results obtained in both these periods, will bear careful consideration when a comprehensive and systematic apprenticeship system is generally adopted.

A Vienna insurance institution figured the net savings in compensation due to the establishment of an ambulance and first-aid medical station to be $25,000 in nine months.

How Bonus Works on the Santa Fé—II

By Fred H. Colvin

A consideration of the advantages and dangers of an elaborate system in repair work; the very complete numbering operations, and the double time-keeping system.

The danger of an apparent or "paper" efficiency; a universal schedule for all shops; the incentive to juggle figures to show a high efficiency, and the failure to charge bonus to labor costs.

The way in which the standardization of motive power has been overlooked until they now have 182 classes of locomotives, which add greatly to the maintenance expense. The commendable loyalty of the employees and the use of graphic charts to collate data.

The vital test of any system—results, and how the Santa Fe shows improvements over its older method.

One is much inclined to criticize the elaborateness of detail with which the time-allowance scheme has been carried out. And yet, if we are to secure the maximum efficiency from every worker in every department as we are told by those who academically manage imaginary shops, it is the logical thing to do. Practically, we know that there are many cases where the results do not warrant the cost. This is the point where the cost doctors disagree.

Then too, we must remember that the conditions on the Santa Fé are very different from the ordinary manufacturing establishment on account of its size and the number of men employed. A company with 10,000 miles of road and approximately 14,000 men, could well afford to compile and print time schedules which would be an unwarranted expense on a smaller road.

While, in order to be strictly logical, it is the proper thing to carry standard time and the bonus system to every particle of work which is to be performed, there are many objections from a practical point of view, some of these being pointed out by Mr. Emerson himself.

As soon as we begin installing any system we are apt to become impatient to extend it to every department, especially if we are fortunate enough to begin in some department which shows good results from it. Mr. Emerson found this, and is credited with the statement: "That it was far more important to know that you were securing economy from its application in a few departments than it was to force its application into departments where the economy was doubtful or could only be small."

Centralizing Manufacturing

The concentration of all tool manufacture at Topeka was a step in the right direction, as was the plan of making this the manufacturing headquarters for all parts that must be carried in stock for standard repairs. The various division points draw tools or parts from Topeka just as they would buy them from any dealer. This has naturally reduced the total amount of stock carried by the road to a considerable degree.

Lathe, planer and similar tools are made up with cutting edges ground to such angles as has been decided on by those in charge of this department. These are largely based on the results given in the "Art of Cutting Metals," by F. W. Taylor. There is, however, no attempt to make it a crime to depart from these angles at the different shops should those in charge decide it to be advisable. This flexibility is to be commended and is probably largely due to the fact that Mr. Jacobs and Mr. Whiteford, who have had actual shop experience for a long period, find that the individuality of the workman cannot be safely or economically ignored.

There is no question as to the economy of concentrating manufacture in this way except the very natural tendency to overstock with some parts. This criticism has been raised against the Topeka shop and may have been true when the concentration plan started. But there was no evidence of this at the time of my visit, the plan being to keep about a three-months' supply on hand.

The Numbering System

The numbering system referred to in the first article is given below. In use the first number indicates the class of work or the shop department in which it is done, the letter shows the part of the locomotive and the last figures, the actual work done on the piece. Thus 1 *C* 3 would indicate that the valve motion was assembled in the erecting shop.

Standard Schedules

NUMBERS ASSIGNED TO SHOPS

1—Erecting shop
2—Machine shop
3—Boiler shop
4—Blacksmith shop
5—Tin shop
6—Pipe shop
7—Paint shop
8—Carpenter shop
9—Roundhouse
10—Miscellaneous (water service, pile driver derricks, etc.)

Standard Schedules

LETTERS ASSIGNED TO DETAILED PARTS

A —Cylinders
B —Frames and frame braces
C —Valves and valve motion
D —Guides and pistons
E —Main and side rods
F —
G —Carrying gear
H —Leading and trailer trucks
J —Driving and truck brakes
K —Driving wheels and boxes
L —Steam and dry pipes
M—Boiler mountings
N —Cab and wood work
O —Pipe and tin work
P —
Q —Air brake mechanism
R —Boiler shell, firebox, fines and smoke box
S —Ash pan, grate rigging and draft appliances
T —Superheater
U —Tender
V —
W—Miscellaneous locomotive
X —Miscellaneous other than locom
Y —Tools
Z —Miscellaneous—foremen, office, etc.

Note—Driving wheels and boxes originally assigned letter *F* changed to letter *K* after June 1, 1911.

Standard Locomotive Shop Schedules

NUMBERS ASSIGNED TO OPERATIONS

1—Adjusted
2—Applied
3—Assembled
4—Babbitted
5—Bend
6—Blocked
7—Blow out
8—Bored
9—
10—Centered
11—Cleared
12—Chipped
13—Closed
14—Connected up
15—Counterbored
16—Crated
17—Cut
18—
19—Delivered
20—Disconnected
21—Dismantled
22—Drilled
23—
24—Examined
25—Faced
26—Filed
27—Filled
28—Filleting
29—Fitted
30—Framed
31—
32—Gained
33—Glazed
34—Ground
35—
36—Inspected
37—Laid out
38—Lined
39—Lowered
40—
41—Made
42—Marked
43—Measured
44—Mortised
45—Moved
46—Oiled
47—Overhauled
48—Pulverized
49—Packed
50—Patched
51—Pieced
52—Placed
53—Quartered
54—Raised
55—Reamed
56—Reduced
57—Removed
58—Removed or replaced
59—
60—Renewed
61—Repaired
62—Riveted
63—Rounded
64—Retapped
65—Sawed
66—Scraped
67—Secured
68—Shimmed
69—Set
70—Spliced
71—Stenciled
72—Straightened
73—Stripped
74—
75—Tapped
76—Tested
77—Threaded
78—Tightened
79—Trammed
80—Trimmed
81—
82—Washed

Bar, Transmission

HANGER, FRAME PIN

1C17–1 Applied new. Rate....
Applying one (1) new transmission bar hanger frame pin. Includes reaming hole in frame and applying new pin with nut and cotter, complete.
Per pin.
1–Classes E28, F18, G23, L25, M20 ....
2–Classes F27, I32, I33..... ....

1C17–11 Applied. Rate....
Applying transmission bar hanger frame pin. Includes driving in, putting one nut and applying cotter. Per pin.
1–Classes E28, F18, G23, L25, M20 ....
2–Classes F27, I32, I33..... ....

1C17–2 Filed. Rate....
Filing transmission bar hanger frame pin bearings when out of round. Per pin.
1–All classes..... ....

1C17–3 *Removed* Rate....
Removing one (1) transmission bar hanger frame pin. Includes removing nut and driving out pin. Per pin.
1–Classes E28, F18, G23, L25, M20. ....
2–Classes F27, I32, I33..... ....

1C17-4 Removed and replaced. Rate....
Removing and replacing one (1) transmission bar hanger frame pin. Includes removing nut, driving out pin, and reapplying, complete. Per pin.
1–Classes E28, F18, G23, I25, M20 .....
2–Classes F27, I32, I33. ....

1C17-5 Nuts tightened. Rate....
Tightening nuts on transmission bar hanger frame pin, and adjusting cotter. Per pin.
1–All classes ....

1C17-6 Threaded. Rate....
Rethreading transmission bar hanger frame pin when threads are bad. Per pin.
1–All classes ....

Bar, Transmission

HANGER, OIL CUP

1C19-1 Applied. Rate....
Applying one (1) transmission bar hanger oil cup to hanger. Per cup.
1–All classes.
a–under engine..... ....
b–on floor ....

1C19-2 Removed. Rate....
Removing one (1) transmission bar hanger oil cup. Per cup.
1–All classes.
a–under engine..... ....
b–on floor ....

Cover.

1C19-3 Removed or replaced. Rate....
Removing or replacing transmission bar hanger oil cup cover. Per cover.
1–All classes.
a–under engine..... ....
b–on floor ....

SCHEDULES IN DETAIL

These schedules give operation details complete enough to satisfy the most exacting requirements of manufacturing and when we consider that they are for repairs of locomotives, we may be pardoned for being skeptical as to their accuracy or real efficiency. While it is probably true that if we average up enough locomotives, there is a time allowance for filing a hanger-frame pin which will be fair to both the employees and the company, we must remember that the same man does not get all of this work and it is quite possible that one man might get all the easy jobs and another most of the hard ones.

Repair work is such an uncertain quality, especially in the case of locomotives where not only wear, but accidental damage must be reckoned with, that it makes a hard and fast time allowance a delicate matter. And it is doubtful if any real economy is to be had by applying such minute details to repair work under such uncertain conditions. Many of the other schedules are subject to the same criticism, and it is quite probable that many of these schedules were introduced with a desire to make them complete rather than that they were especially useful.

When a locomotive is ordered to the shops for repairs, a statement showing the repairs to be made in detail is forwarded by the master mechanic who has charge of the locomotive in service.

On arrival at the shop a locomotive inspector makes a careful check of the master mechanic's report and of the condition of the engine, in order to discover whether any repairs ordered are unnecessary and whether any necessary repairs have been overlooked.

When this inspection is completed, he makes a full report to the shop superintendent who then determines the repairs to be made and issues instructions to the general foreman of each department accordingly. These instructions are transmitted by the general foreman to the individual gang foreman and they in turn to the individual workmen.

As the operation is completed, the workmen, or gang foreman, indicates in the proper place the amount of time taken to complete the work.

DOUBLE TIME KEEPING

In addition to this, each workman has a daily time slip which he uses with a time clock, ringing in his hour of arrival and departure, as is customary in many places. There is also another large card which is filled in by the bonus inspector as he passes each piece of work or operation on it. In some cases this becomes a job card, and in others it is simply an individual workman's card, which gives the time required to perform certain operations on a given piece, or the complete piece, as the case may be.

It also records the different machines used to secure these results, and is in reality a double system of time keeping, which shows in detail every operation performed on a job, as well as all the work done by each man in the gang. Each bonus inspector is supposed to look after about 50 men so that he is kept constantly on the move from one man to another of his department, and, in addition to keeping the time of the men, he inspects the work to see if it has been properly done.

A further elaboration is found in the bonus inspector's office, where a large chart gives considerable space for each machine by number, and in this space are recorded all the various operations which have been performed by that machine. This is also filled in by the bonus inspector and adds to his clerical duties.

THE BONUS INSPECTORS AND THEIR WORK

Bonus supervisors and inspectors have nothing to do with shop discipline, but simply keep track of the work going through, both as to its quantity and quality, and are divided as follows: Bonus supervisors, bonus assistants or demonstrators, bonus clerks and bonus inspectors, whose duties are divided as will be seen.

The bonus inspectors at Topeka are, I was informed, men who understand machine work thoroughly and inspect the work as well as record it. This, however, is not the case at all points, the main requirement in some cases being that he shall write a legible hand, which is not always the case with the skilled man, so that a roundhouse wiper is occasionally impressed into the service.

The time-keeping duties do not seem to belong to the inspector, and the double time keeping—the inspector's written report card in addition to the man's own time card—seem unnecessary. In fact, many consider it very bad policy to make clerical work a part of the duty of any skilled man. If the inspector is skilled, as he should be, he should not be a time keeper. If time keeping is the most important, a clerk should do it and not a skilled man.

Then, too, the hurried inspector does not always write a Spencerian hand and it is extremely doubtful if all the entries on the cards are actually read by anybody. Anyone who is familiar with the chirography of the average mechanic, no matter what his ability, can readily see one of the difficulties of such a system. In fact, it is directly against general, usually acceptable ideas to turn a mechanic into a clerk of any kind.

The claim is made that it is necessary in order that the workman shall get full credit for his work, and that the inspector shall be sure that the work has actually been done, which is a much more difficult proposition on repairs than on new work But the charges that the inspector does not always inspect, that locomotives are turned out of some division points only partially repaired in order to show a high standing on the efficiency report, crop up with such frequency and at such widely separated points, that one is forced to believe the inspector has too much clerical work and neglects the real inspection. Needless to say this is not real efficiency, as when work has to be done over at a small shop, it is a very expensive proposition.

HOW THE BONUS SYSTEM WORKS

It is the theory of all bonus systems that everyone who is instrumental in increasing the efficiency of a plant be rewarded by a bonus which shall represent his share in the desired result. This has much to commend it and yet it can readily be shown that it contains an element of danger, unless it is very carefully planned and applied. When the bonus can be reckoned from an actual net savings of total costs, there can be no objection to extending it to all departments, in fact it is the logical thing to do. It is only when the character of the work or the conditions under which it is done make it practically impossible to know accurately the net results, that it becomes a danger and is liable to grave abuses.

THE ROAD FOREMAN'S BONUS

The method of awarding the bonus to executives can be seen from the portion of the schedule for road foremen of engines which follows. Similar methods are used in awarding the bonus to other executives.

"In ascertaining the operation efficiency for the current month, use the records closing with the second month previous

and consider the following allotments for each item as constituting 100 per cent. efficiency on this division. The relative value or proportion which each item bears in the determination of the operating efficiency is shown in the column headed 'Relative Values.' In calculating the operating efficiency of the division multiply the efficiency for each item by the corresponding figure in the 'Relative Values' column, add together the figures thus obtained and divide the total by 100.

	Allotment	Relative Values
1—Locomotive repairs (frt. and pass.) per 1000 gross ton mile		20
2—Locomotive miles between shoppings, average per engine		15
3—Average miles per locomotive failure		20
4—Total pounds fuel per 1000 gross ton miles		15
5—Total cost of lubricants 1000 gross ton miles		10
6—Total cost of other supplies per 10,000 gross ton miles		10
7—Average miles per month per locomotive assigned		10

The earnings of road foremen of engines on efficiency of division performance are computed on the special 20 per cent. efficiency table and distributed monthly."

The Road Foreman's Bonus

The following extracts from a form letter to road foremen show the details necessary in extending the bonus system to this department. Seven items are considered, these being listed in the summary:

To Road Foremen of Engines—In recognition of efficiency and economy in operation of divisions, it is proposed to share with road foremen of engines a proportion of the savings effected by their efforts. The efficiency of the division performance is measured by the following factors:

1. Locomotive repairs, per gross ton-mile (freight and passenger) 12 months' average.

(Total cost of repairs, exclusive of wreck and extraordinary, form 2119) ÷ (gross ton-miles, freight and passenger, form, special.)

2. Locomotive miles between shoppings, average per engine.

(Average mileage of freight locomotives since last heavy or general shopping × 2) + (average mileage of passenger locomotives since last heavy or general shopping) ÷ 3 (form 2119.).

3. Average miles per locomotive failure, 12 months' average. Form 1261.

Some of the Difficulties

There is no class of work which varies to a greater extent than railway repairs and in many cases it is obviously impossible to estimate in advance the amount of work which will be necessary to put a locomotive in good running condition. Assuming, therefore, that it is possible to set a standard time on each separate operation when the extent of that operation is known, it is obviously impossible to do so in a single schedule without making many allowances for the amount of wear which has taken place in the various parts. The only real check as to whether the work is sufficiently done or not is the average total cost of locomotive repair per paying unit of work done. For, if a report is based on mileage, efficient repairing might be offset by an inefficient use of the locomotive, by so placing it that it was obliged to run a considerable proportion of the time without a paying load.

Advantages and Weaknesses of a Bonus System

Any bonus or premium system which is based on a time allowance for the performance of work has more flexibility and can be installed in most cases with less difficulty than where a certain price is fixed per piece.

By the use of an hourly rate or standard time, as it has come to be called, it requires no change in the schedule whether the work is done by a 30-cent or a 40-cent man, for assuming that both are capable of doing the required quality of work, it is to be supposed that the 40-cent man will do it in less time than the man at the lower rate, so that, while the man will make many more pieces per day, the cost per piece may easily be less than with the lower-rate man.

Then, too, as sometimes happens, you wish to reward long and faithful services for extra care in the tools and machines used, and can easily do this by increasing a man's rate without in any way disturbing the standard time or schedule.

It is also being recognized that some men are worth more than others, even though they do not perform the work in any less time, on account of the better care they take of the machines and tools being used, and this makes it very easy to reward such men in a substantial and satisfactory manner, without making special rates or applying special rules to them.

Paper Efficiency

The great weakness of any bonus system is what might be called the cumulative error, due to "paper" or apparent efficiency, which may begin with the individual workman and only end with the highest man on the list who receives a bonus. And this cumulative error is more easily possible in repair work, such as exists in railway shops, than in manufacturing a new product. In fact, it may be said that the danger in manufacturing is comparatively small.

Suppose a valve motion is to be overhauled. The foreman is always busy and an examination indicates that it will be necessary to close the links at both ends, bush the holes and do a number of other things which are familiar to all men in this kind of work. On taking the link apart, the workman finds that it is only necessary to close one end, and that very slightly, and that he can also save considerable time at other points of the operation.

If schedules have allowed him a certain number of hours to do the job, and he finds that with the work which is necessary he can do this in very much less than the standard time, it is much easier to charge up the full schedule than to note the difference. The inspector is also busy, and he would be more than human if he could tell positively that both ends of the link had not been closed. So that it becomes a very easy matter to have the work on the job recorded according to the foreman's schedule and the workman's efficiency comes up away above 100 per cent.

As every increase in efficiency of the men also increases the "efficiency" and the bonus of the inspector, the foreman, and all above, everyone has benefited financially by this move, and every man from the lowest to the highest has received a bonus on apparent efficiency secured by simply crediting one man with work he has never performed.

Everyone wins but the stockholders, who have been forgotten so long that few railroad shop men ever think of them. They only become prominent when the railroads want to raise rates, or to protest against decreasing them. Then we find that they are mostly lone widows and orphans, about whom they display so much solicitude that you would suppose they were always uppermost in their minds.

Building a House of Cards

As long as everyone all along the line benefits by this, it is very easy to see how errors or misstatements of this kind could accumulate. And, knowing how the bonuses count up for everyone, it can easily be seen that it is not difficult to build up a house of cards which shows apparently high efficiency, while in reality exactly the reverse may be true.

It is in fact openly charged by many who are familiar with the work done at different points along the Santa Fé, that the system as now used is subject to this criticism. And the fact that the same schedule is expected of a small shop at a distant point, as at Topeka, would seem to give color to such a condition of affairs.

Weakness of the Universal Schedule

Mr. Emerson must be commended for establishing a different schedule for each

shop in order to allow for the difference in equipment, in climatic conditions and other surroundings which are not apt to be considered unless one is familiar with the individual plants. The adoption of a universal schedule is evidently a mistake and responsible for much of the apparent or paper efficiency which shows in reports, but not in the actual saving of dollars.

We are all very apt to fail to see a reason why a man should not work as rapidly as we do at some other point, owing to our inability to realize the difference between a temperate and tropical climate, unless we are personally familiar with it. It is clearly impossible for men at Needles, Calif., where the temperature is extreme for three months in the year, to work with the same real efficiency as men at Topeka, Kan., even with the same equipment, and yet they are expected to turn out work by the same schedule. For this reason I believe it is a step backward in establishing a universal schedule as has been done, although it undoubtedly simplifies clerical work at Topeka.

The answer is made to this objection that experience has shown that the efficiency at the various points averages about the same, with all the varying conditions. This might perhaps answer the question if new work was being manufactured and the records so kept that the exact cost of each piece could be secured. But to anyone who is familiar with railroad repair work and also with human nature, this is not at all satisfactory.

Danger of Losing Personal Contact

Then, too, any very large organization pays part of the penalty of its greatness by losing to some extent the element of personal touch which exists and which counts for so much in many smaller institutions. In fact one of the mistakes of many so called efficiency systems is the separation which takes place between those who are responsible for the system, and the men who are actually doing the work at various points. As soon as the actual producer begins to look upon the system as a separate organization, and his only contact with it is in the nature of reports showing his efficiency or the lack of it, it is not possible to secure the same systematic results.

I am not accusing the Santa Fé organization of this difficulty, as it apparently makes every attempt to keep in personal contact with the men from the chief inspector down. But there is no denying that any system of reports which compares one point with another, where different conditions exist, and which has a follow-up, mail-order system calling attention to an apparent falling off in efficiency, has a great tendency to make different points "give them any old efficiency they want," as has been remarked at different points. It is similar to the common experience in shops using straight piece work, of asking the foreman "how much they dare make" on a certain job.

It is only human nature to give a superior the kind of a report he is looking for, and if a high efficiency is looked for and demanded where it is impossible to secure it by fair means, it is very apt to be found in other ways. It can be readily seen that a little leniency on the part of an inspector and the men would easily increase the apparent efficiency of every man in the shop, and when the foreman was busy, as he always is, and knew that certain efficiency was expected, he might perhaps be pardoned for not inquiring too closely into the results obtained.

In fact, I am informed that there have been several cases where an apparently large drop in the efficiency of a shop has been followed by a marked decrease in the actual cost of repairs to locomotives, due to a careful watch being kept on the work being done. It is also charged that in some of the shops where there is apparently the highest efficiency, the actual cost of maintenance of locomotives per year is the highest, because the work is not properly done at each shopping. And that locomotives which come from here usually require considerable work done at the division point before going into service.

Bonus Is Not Charged to Labor

One feature of the accounting is unusual, and also questionable, when we desire to know the actual cost of locomotive repairs or the savings which have been effected by the introduction of standard time. This is the charging of the bonus to the overhead expense or burden instead of to productive labor or to the actual cost of the work done. It can be readily seen that this would make considerable difference in the actual cost of repairs when a shop is showing an efficiency of 120 per cent. as has been done in a number of cases. Charging this to the job, where it clearly belongs, would increase the labor cost 40 per cent. and add considerably to the recorded cost of maintenance of locomotives.

Most Important Standards Overlooked

While standard time is important in manufacturing and in repair work as far as possible, the standardization of all equipment is equally important, and this seems to have been overlooked in some particulars on the Santa Fé. While small tools have been largely standardized and a printed volume showing the different standards has been issued and supplied to all division points, there has been a constant increase in the types of locomotives which are here probably many times larger in number than any other railroad in this country.

In fact it may be said without fear of contradiction that the Santa Fé has tried and is trying out more new designs, some of which very closely approach the border line of freakdom, than any other road, and that the cost of this must be larger than anyone realizes. This must not, however, be charged against standard time or any other efficiency system, but simply a failure on the part of the responsible officials to follow their own principles in this very important department.

Their records show 182 different classifications of locomotives, which is an increase of 17 in less than three years, and when it is considered that repair parts must be kept for all, or most, of these, some idea of the enormous cost of this constant trying out of new types must be enormous.

In making comparisons of this or any other kind, it is necessary to consider all conditions and to recall that they cover 10,000 miles of road, which includes about all railroad conditions from level prairie to 3½ per cent. mountain grade. But I believe that it is perfectly safe to say that every variety of their work can be handled with 5 or at most 10 per cent. of their present types of engines, with a decided saving in operating expenses as well as repairs.

There must, of course, be constant experimenting in order to try out improved ideas, but it is not necessary to go headlong into balanced compounds, superheaters, new fire boxes and other devices until we know exactly what they are going to cost year after year, and have proved conclusively whether they are satisfactory or not. Real efficiency demands that attention be paid to every factor in the operation of a plant, whether it be a shoe shop or a railroad, and when every roundhouse foreman knows that a certain type of locomotive is costing 50 to 100 per cent. more to keep on the road than other types doing the same work, he is apt to become skeptical in regard to all efficiency programs, and it is extremely difficult to maintain real enthusiasm under such conditions.

Santa Fé Loyalty

Everything possible seems to be done to instill a spirit of loyalty to the Santa Fé on the part of all the employees. The monthly magazine published gives interesting articles tending to acquaint men of all departments with the system as a whole. It also pays particular attention to the personal factor in all departments —a department being devoted to giving credit to men in all branches of the service for meritorious action.

This department includes any action showing thought and care on the part of any employee, such as assisting passengers beyond the mere line of duty, prompt action in emergencies, and sim-

ilar instances which show a real interest in the work.

There is also an organization to promote safety in the shop and on the road. Members wear "Get the Safety Habit" buttons and have accomplished much in the way of reducing accidents.

Using Graphic Charts for Railroad Data

The Santa Fé makes the most extensive use of graphic charts, or as they are familiarly called, "graphs."

As soon as the yearly report of the Interstate condition has been issued, they send men to Washington to compile the data in various forms so as to see how their road compares with the other leading railroads in the country. And while it might perhaps seem as though this was carried to the extreme in some cases, it certainly shows an earnest attempt to secure information which will show them exactly where they stand with relation to other roads.

Unfortunately it is all too easy to draw erroneous conclusions as some of the figures do not convey really intelligent information unless we know more of the operating circumstances of each railroad than is usually the case. They are to be commended, however, for their attitude toward the Interstate Commerce Commission and their suggestions and endeavors to make the information of more value instead of being antagonistic to it as in the case of a number of the other roads.

The Vital Test of Any System

But after all is said and done, after all the good points have been commended and the weak spots criticised, the vital test of any system is the actual result in dollars and cents, assuming all conditions to be as satisfactory as before.

And even the most skeptical oldtimer must admit that the cost of maintaining locomotives has been reduced on the Santa Fé—if we study the results at all fairly. True, there were years of stress when the cost increased but the net result has been a lowered cost and must be credited to the installation of the system as outlined.

It is also true, as has been the case in too many shining examples which have been advertised by efficiency engineers that few more fertile fields for improvement could have been found. There are shops still in existence where almost any change would be an improvement, and from all accounts several of these existed in the old days of the Santa Fé. Nevertheless we must credit the system with the improvement obtained, carefully noting that the same system might easily fail to produce similar results if installed in a shop which was already highly efficient.

Comparisons Easily Misleading

This fact affects the value of such comparisons as are shown by any kind of comparative report which can be made. The Interstate Commerce Commission report shows, for example, that while repairs and renewals of locomotives increased on practically all the large roads, the increase for five years was much lower on the Santa Fé than any other Western road. The St. Paul shows an increase of 56 per cent., the Northwestern of 32 per cent. and the Santa Fé about 7 per cent.

While this might easily be taken as a tremendous gain over other roads, this is not necessarily the case. The figures compare the increase in cost of maintenance for five years ending 1910 with the same period ending in 1905. So it is easily possible that the cost of repairs on either the St. Paul or the Northwestern may have been extremely low previous to 1905, while the cost on the Santa Fé was abnormally high during that period as was undoubtedly the case. The showing is one to be proud of, however, but should not lead us to making erroneous comparisons.

Maintaining Shop Machinery

The report on the maintenance of shop machinery and tools per pound of tractive force for the year shows the Santa Fé the lowest at 39 cents with the Union Pacific next at 55 cents and gradually increasing, up to the New Haven railroad at 98 cents. As the Santa Fé has given this point very careful study, it is quite probable that these figures represent the actual conditions fairly well.

The various reports should be particularly pleasing to all connected with the Santa Fé, as they show decided improvements in costs over the periods previous to 1905. Whether they are as good as they should be when the size of the system, the opportunity to manufacture many parts in large quantities and other advantages are considered, must be determined by the reader. Many practical railroad men who are making a good showing on smaller roads, contend that they could easily be better. And some of the observed results of the way the bonus works, or is worked, whichever you prefer, lead one to this conclusion.

If the standard time set and used for new work at the Topeka shop was all that it should be, it would be possible to manufacture parts as cheaply as anywhere in a shop of that size, as they naturally use a large amount of new material in repair work. And yet we find that many, if not all, the spared parts, such as locomotive cylinders, pistons and piston rings, are bought from a comparatively small shop 50 miles away.

Repair Parts for Less Money

There is no doubt that such a shop as that of the Locomotive Finished Materials Co. at Atchison, Kan., can make locomotive parts for less money than the average railroad shop because it makes a specialty of manufacturing and has a well equipped shop for this work. But it is not easy to see how it sells these parts for less money than a shop like that at Topeka, with its larger capacity, could make them for, unless we admit that the Topeka shop is less efficient than we have been led to believe from the elaborateness of every detail connected with the work.

And it is a still further shock to find that, though the shop at Atchison has had the example of Topeka before it since its inception, it has not adopted the standard time and bonus. The management fully appreciates the advantages of knowing what work costs and maintains a close watch on the time required on all classes of work and keeps a very close record of it. This might perhaps be called an adaptation of standard time; it is not the genuine, patented article and has no bonus, although this will in all probability be added later.

This simply shows that the adoption of any elaborate system does not necessarily mean economical production, no matter how good that system may be, nor that shops which are struggling along without it are necessarily as inefficient as might be supposed. The quotation from Disraeli that: "We have put too much faith in systems and too little in men" is borne out here as in many other cases.

But, regardless of the evident failure of the elaborate system of the Santa Fé to accomplish *all* that was hoped, and for the reasons shown, they are to be heartily commended for what has been accomplished and for the endeavor to improve conditions generally. Their efforts are much to be preferred to the self-satisfied attitude which too many managers of railway systems have assumed and are still endeavoring to maintain.

Dedication of the New Ohio Mechanics' Institute

The new building of the Ohio Mechanics' Institute at Cincinnati, was formally dedicated Monday Jan. 8, and each evening of the week beginning with that date was devoted to public exercises which were attended and taken part in by the different organizations of business men, manufacturers, and teachers. The exercises were followed by a general inspection of the new institute building and its various departments.

In tapping some one-inch holes in mild steel a machinist found that the oil ran through the hole. To overcome this he made a thick paste of red lead and lard oil. This method worked very satisfactorily.

Making Knight Motor Valve Sleeves

By Ethan Viall

Boring, turning, drilling and grinding operations on their cast-iron sleeves that must be very accurately finished.

The Stearns Motor Co., of Cleveland, Ohio, one of the well known automobile producers adopting the Knight type of motor, has some interesting shop practice in connection with the machining of the cast-iron valve sleeves.

For those not familiar with the construction of the Knight motor, a sectional view is given in Fig. 1, showing the operation of the valve sleeves by means of cranks and short connecting rods at *A* and *B*. This motor has already been described in detail in these columns, so no further notice will be given the motor itself, but in order to make the machining operations perfectly clear, cuts of the inner and outer sleeves are given in Fig. 2, which show the principal sizes and the limits allowed.

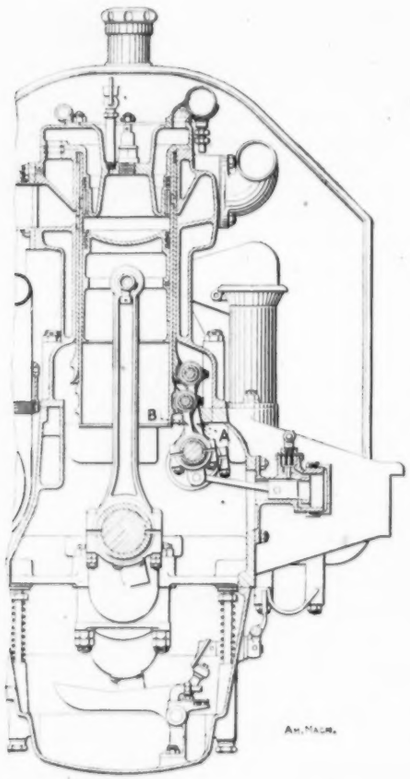

FIG. 1. SECTIONAL VIEW OF KNIGHT MOTOR, SHOWING OPERATION OF THE VALVE SLEEVES

From the fact that the piston fits the bore of the inner sleeve, the inner sleeve the bore of the outer sleeve and this the bore of the cylinder, considerable care and accuracy in the machining processes are necessary.

BORING AND TURNING

The operations on the two sleeves are practically the same, the first operation being to chuck the rough casting in a Gisholt lathe, as shown in Fig. 3, bore it out and flare the outer end, after which it is placed on a mandrel and rough turned, as in Fig. 4. The sleeve is next pressed on a plug mandrel held in a lathe spindle and guided by a steady rest, is cut to the correct length, as shown in Fig. 5.

Countersinking of the inner end is done on a driller, the sleeve being held by the jaws of a universal lathe chuck fastened to the table, and the work is done by a large countersink held in the spindle, as in Fig. 6.

Fig. 7 shows the finish turning, the sleeve being held between large centers and driven by a dog, on the live center, which rests between the connecting-rod lugs. The oil grooves are also cut in at this setting, using a round-nosed tool, after which the spiral rows of oil holes are drilled, using the jig shown in Fig. 8, which slips over the sleeve, being located by a projecting piece *A* fitting between the lugs and clamped fast by a strap *B*, pins like *C* locating the jig lengthwise of the sleeve. The clamping strap is slotted so that by loosening the wing nut *C* it may be swung around and out of the way.

MILLING THE SLOT

The space between the lugs is milled out for the end of the connecting rod by placing the sleeve in the jig, shown in Fig. 9, the end of the sleeve fitting over a plug and held there by means of a bolt, adjustment in order to bring the lug vertical and steady it during the cut, is obtained by setscrews on either side.

After milling, the pin hole is drilled by using the jig shown in Fig. 10, the sleeve being set over a plug and fastened in the same way as on the milling jig.

MILLING THE PORTS

The long holes for the inlet and exhaust ports are milled out with an end mill, using the fixture shown in Fig. 11. In this fixture the sleeve is held to the

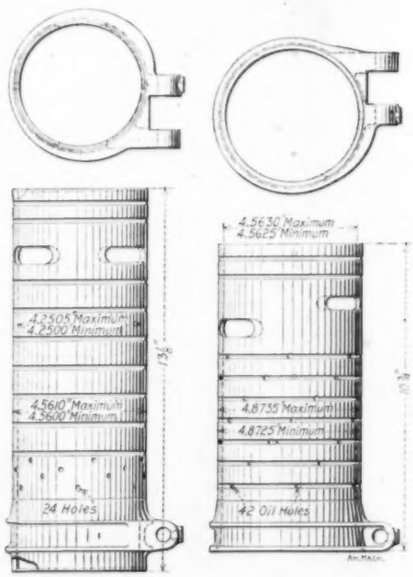

FIG. 2. INNER AND OUTER VALVE SLEEVE

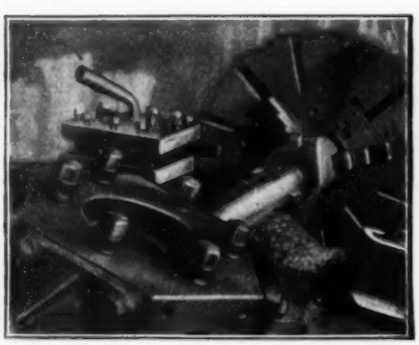

FIG. 3. BORING OUT A CASTING

FIG. 4. ROUGH TURNING

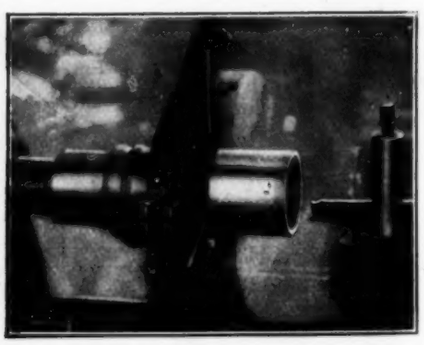

FIG. 5. CUTTING TO LENGTH

plate *A* in the same manner as in the two previous jigs, but is located according to the port to be milled, by means of blocks like *B* and *C*, over which the lugs of the sleeve fit. After the hole for the mill is cut through the shell of the sleeve, the slot is cut by turning the wheel *D* by means of the handle *E*, which causes the nut *F* on the screw *G* to travel and move lever *H* according to the direction in which the screw is turned. This lever is bolted to the plate *A*, which has a rotary movement around a center pin, the arc of travel being limited by the stops *I* and *J*, which determine the size of the ports milled. The plate or table *A* may be given a stiff movement or locked fast, as desired, by the clamp *K* and another similar one, not shown.

Grinding and Inspecting

The sleeves are finish ground by placing on mandrels and grinding the outside first in a regular grinder, plenty of water being used, then they are ground on the inside by slipping them into water-jacketed bushing on a Heald grinder, as shown in Fig. 12, the water being supplied to the jacket through the hose from above and all dust and grit from the inside of the sleeve is drawn out through the tin tube at the back.

After the final grinding the sleeves are all carefully inspected, special ring and plug limit gages being used to insure the proper sizes, and the correctness of the ports and connecting-rod slot are also tested by special gages, extreme care being taken to prevent defective or inaccurate sleeves from getting past the inspector.

Fig. 6. Countersinking the End on a Driller

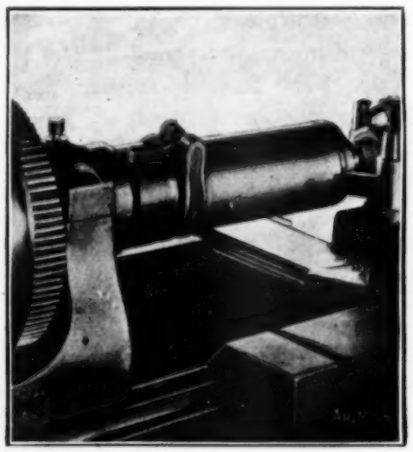

Fig. 7. Finish Turning and Cutting Oil Grooves

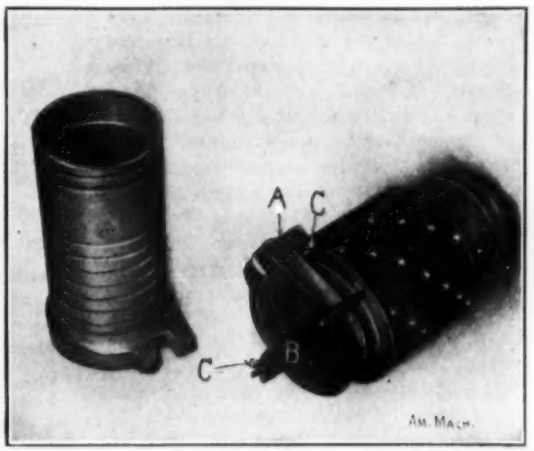

Fig. 8. Drilling the Oil Holes after the Grooves are Cut

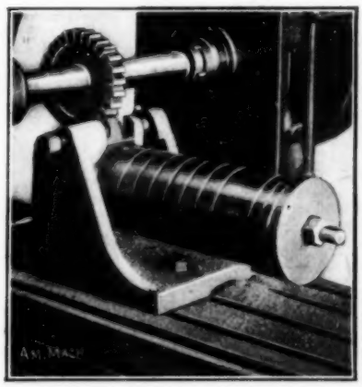

Fig. 9. Milling Connecting-rod Slot

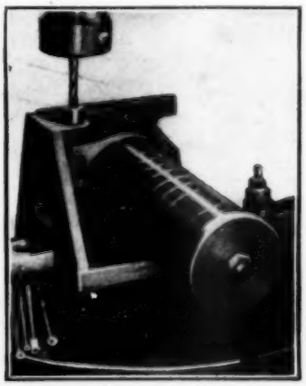

Fig. 10. Drilling the Pin Hole

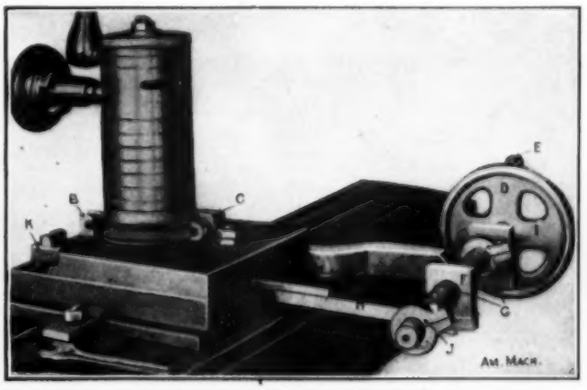

Fig. 11. Special Port-milling Device

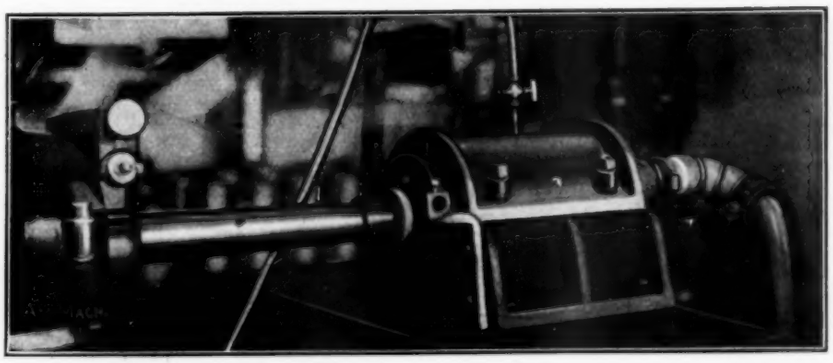

Fig. 12. Water-jacketed Fixture for Holding Sleeves While Grinding the Bore

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An alloy, originating in France, and reported to accomplish useful results in coating sheet iron for constructional purposes, consists of zinc, 5.5; lead, 23.5; tin, 71. If the metal is of a fine white color and high luster, 5 to 10 per cent. of bismuth may be added, making a composition of tin, 90 to 95; bismuth, 10 to 15. An admixture of one-half, or at most 1½ per cent of iron in tin greatly increases its hardness and durability.

Comparative Tests of Planer Drives

By Samuel S. Roberts*

The two types investigated are the belt driven and reversing-motor driven. The peak loads at reversal with the first are considerably over double those of the second mentioned. Further, the belted type required 48 per cent. more time to complete a specified facing cut, though the horsepower expended per cubic inch of metal removed was practically the same.

*Testing Engineer, Carnegie Steel Co.

The investigation from which the accompanying log table and chart were prepared, was undertaken for the purpose of comparing the two types of planer drives, belt and reversing motor, under like conditions as regards feeds, depths of cut, lengths of stroke, and stock machined; also their respective maintenance charges for a specified period.

The reversing-motor drive tests were conducted at the plant of the Rosedale Foundry & Machine Co., on a 48-in. Pond planer, equipped with a 20-hp., 1:4 speed, 250 to 1000 r.p.m., interpole Garwood motor, and magnetic controller furnished by the Niles-Bement-Pond Co. In order to develop the capacity of the motor (77 amp. at 220 volts), both tool heads were placed in service, with $\frac{5}{8}$-in. depth of cut, $\frac{1}{4}$-in. feed, and 28 ft. surface speed, cutting 30,000 lb. tensile strength cast-iron blocks.

The load curve, plotted from the stop watch and ammeter observations, indicates the power requirements for these conditions, taken in connection with the periodical reversals. They are somewhat above the motor's rating, with consequent increase in the temperature rise, as the operations were continued over an extended period. In this particular instance, however, the conditions adopted are doubtless more severe than the size of planer under consideration would likely be subject to in practice. Thus, the motor provided is ample in capacity for the service intended.

The surface speeds, forward and return, as recorded on the log table (determined by a cut-meter), are the maximum speeds attained by the platen after accelerating in either direction. But they are in themselves very misleading if comparative values of planers are estimated on this basis. This is because of the momentary stoppage of the table at each end of the stroke, and the time lost before full speed is attained after reversal.

The productiveness of the tool is materially reduced in the case of the belt-driven machine, due to belt slippage and the flywheel inertia of the pulleys. The only accurate means, therefore, of ascertaining the earning capacity of a planer is to take the cycle time as recorded under the cyclical measurements columns. Thus, average speed $= \frac{2L \times N \times 60}{T}$. The time of one cycle equals time of one cut plus time of one return. In the equation L = The length of stroke in feet; T = The time of N cycles in seconds; N = The number of cycles.

Since the object primarily involved was to arrive at the economy effected by the installation of the foregoing drive in lieu of the existing arrangement, no changes were adopted other than the substitution of a motor belted to the countershaft instead of the line shaft, to facilitate the power measurements. Furthermore, to better demonstrate the capability of the proposed reversing motor direct drive applied to the particular case in hand; namely, a 60-in. planer, the original surface speed under which the machine is now operated was maintained, all other conditions corresponding to the other tests. The belt action indicates a critical load with abnormal wear on the shaft bushings, due to the tight belts necessary to avoid slippage.

An inspection of the graphical outline of the load curves, plotted from the field observations, renders obvious the principal characteristics of the service at any instant by the two methods of driving planers, and emphasizes quite forcibly the superiority of the reversing motor drive.

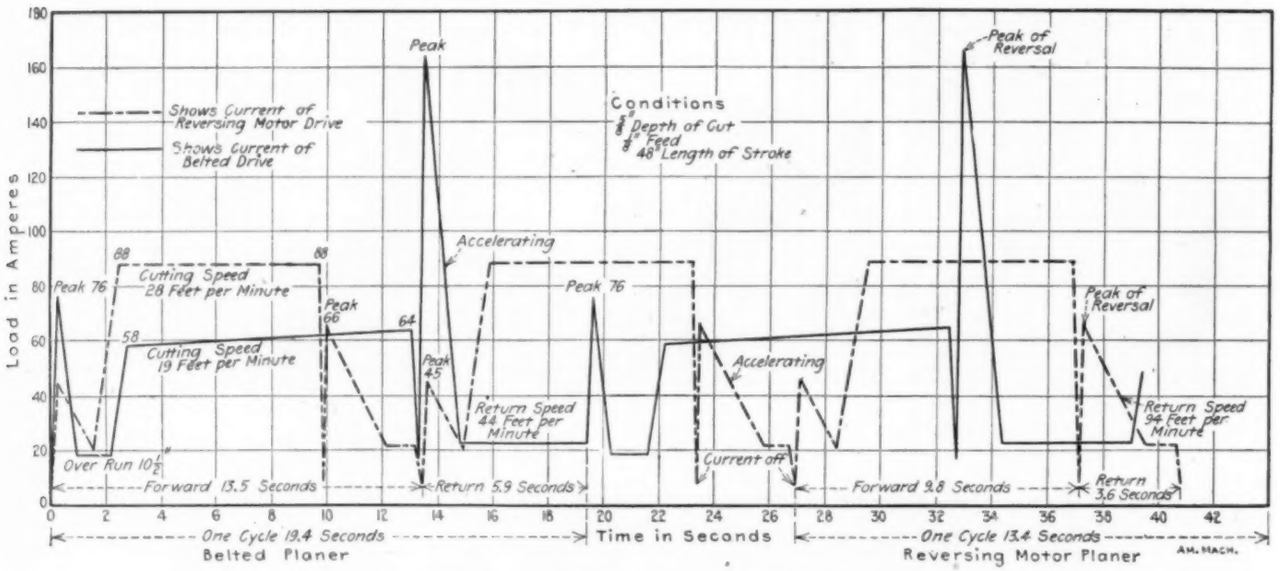


FIG. 1. LOAD CURVES FOR REVERSING MOTOR AND BELTED PLANER DRIVES CUTTING CAST IRON

ANALYSIS OF THE CURVES

The dash-and-dot line curve pictures the ampere load on the 20-hp. reversing motor drive, attached to a 48-in. Pond planer, while taking the cut corresponding to the second test on the data sheet. This curve shows the peak load to start the motor and table is 45 amp. Then as

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Size and Kind of Material	Depth of Cut	Feed of Tools per Cut	Length of Stroke	Speeds		Cyclic Measurements				Stock Removed		Total Time of Operation	Electrical Readings					Temperature Rise at Windings, Atmosphere 68 Degrees Fahrenheit	Load at Motor		Remarks
				Cutting	Return	Time per Cycle	Number of Cycles	Total Time of Cycles	Earning Speed of Planer	Volume of Metal per Minute	Weight of Metal per Minute		Average While Cutting	Average on Return	Reversal for Cutting Stroke	Reversal for Idle Stroke	Average Voltage		Power Developed on Cutting Stroke	Power Expended per Cubic Inch of Metal Removed	
Castings, Size in Inches	Inches	Inches	Inches	Feet per Minute	Feet per Minute	Section		Section	Feet per Minute	Cubic Inches	Pounds	Minutes / Seconds	Amperes	Amperes	Amperes	Amperes	Volts	Degrees Fahrenheit	Horsepower	Horsepower	
Steel 24x72	0.375	0.143	80	32	98	20	9	179.8	40	23.2	6.6	27 / 25	65	28	47	67	230	110	19.3	0.84	48-in. planer, motor drive
Cast iron 24x36	0.625	0.125	48	28	91	13.4	9	120.6	36.2	25.8	6.74	21 /	88	26	45	66	218	121	25.8	1.00	48-in. planer, motor drive
Cast iron 24x36	0.625	0.111	48	24	87	14.8	9	133	30.8	21.4	5.58	24 / 58	84	24	43	61	216	131	24.3	1.13	48-in. planer, motor drive; tools not reground
Cast iron 24x36	0.625	0.125	48	19	44	19.4	9	174	24.2	17.4	4.55	31 / 4	61	18	76	165	222		18.2	1.04	60-in. planer, belt drive
Cast iron 24x36	0.625	0.125	48	17	40	20	9	179	23.5	16.9	4.41	32	62	17	70	151	220		18.3	1.06	60-in. planer, belt drive; tools not reground

TABLE 1. DATA LOG OF COMPARATIVE PLANER TESTS

the speed increases between the time of start to the time of cut, or 2.5 sec., the current drops to 20 amp. Then as the tools cut into the material, the current rises to 88 amp., for 7.3 sec., then the current is off for 0.4 sec.; whence, reversing to high speed, the current rises to 66 amp., and, as the speed was accelerated, the current drops to 21 amp. for a period of 2.2 sec., then straight for 1 sec., which is the full return stroke, thus completing the cycle. This sequence of events and current flow continues by repetition.

Perhaps the most striking characteristic encountered, as might be expected in the belted tools, occurs at the instant of reversals, the peak loads on account of the pulley and belt momentums rising considerably over double the current quantity experienced by the other type, with less linear speed, forward and return, of the platen, and 48 per cent. more time occupied for the completion of the facing cut —though the power expended per cubic inch of metal removed remained practically the same.

Maintenance Charges

Following is an itemized expense account pertaining to the belt-driven, 60-in planer on a yearly basis.

Countershaft repairs: Bushing four times per year two brass bushings, 2-in. bore, 4-in. outside diameter, 9 in. long, weight, 25.7 lb. Time required to replace bushings = 14 hr. Time the planer is idle = 14 hr. at 65c. = $9.10. Time required to machine bushings = 6 hr. at 75c. = $4.50. Time required to fit bushings, two men at 14 hr. = 28 hr. at 25c. = $7. Cost of material = $8.23. Total labor and material cost = $115.30.

Driving-shaft repairs: Bushing 12 times per year, two brass bushings, 3½-in. bore, 5½ in. outside diameter, 7 in. long, weight, 30 lb. at 16c. Time required to replace bushings = 8 hr. Time planer is idle = 8 hr., at 65c. = $5.20. Time required to machine bushings = 6 hr., at 75c. = $4.50. Time required to fit bushings, two men at 8 hr. = 16 hr. at 25c. = $4. Cost of material = $9.60. Total labor and material cost = $279.60.

Belting expense: Eight sets of belts, two belts each, 4-in. double, 41 ft. 6 in. long, at 48c. per ft. = $318.72. One belt, 6-in. double, 30 ft. long, at 72c. per ft. = $21.60. Time planer was idle during belt repairs = 12 hours, at 65c. = $7.80. Labor involved = 12 hr., at 25c. = $3. Total maintenance charge per annum = $746.12.

In opposition to this proposition, the upkeep cost in connection with the reversing-motor equipment can best be answered, perhaps, by quoting from correspondence with the builders.

"We guarantee the operation as well as the good quality of all material and apparatus furnished. As the action is purely electrical, there are therefore no working parts on this device to wear.

Thus there ought to be practically no upkeep expense."

Briefly summarized, the most noteworthy advantages of the electrically controlled drive as recently perfected may not prove amiss. With the elimination of all frictional-drive mechanism, the belting question and its accompanying bushing renewals at once disappear; the platen motion becomes positive, periodically reversing without hesitation or shock at the end of each stroke within one-eighth inch variation. It is possible to obtain very short strokes, 6 in. and less, without excessive wear of the gearing or overloads at the motor.

Formulas for Conical Springs

By G. M. Strombeck

Among the numerous contributions on the subject of springs, none has come to my notice that deals with those of a conical shape. Yet this forms a very important class particularly for smaller springs, such as for gas-engine valves.

Having to design a number of such springs and being unable to find a suitable formula, the following was deduced:

A Conical Spring

Referring to Fig. 1, let
D_1 = Mean maximum diameter,
D_2 = Mean minimum diameter,
d = Diameter of wire and
N = Number of effective coils.

By effective coils are meant such as are free to act under load. Usually the coil at each end has a full bearing at all times and must, therefore, be deducted from the total number of coils to obtain the number of effective coils.

There are usually two things that must be known about a spring; (a) the load it will carry without exceeding a given fiber stress, and (b) the deflection under loads. For a cylindrical spring these conditions are expressed by the following well known formulas:

$$P = \frac{\pi d^3 S}{8 D} \qquad (a)$$

$$f = N \frac{\pi D^2 S}{G d} \qquad (b)$$

where
P = Total load in pounds,
S = Maximum fiber stress,
G = Torsional modulus of elasticity,
f = Total deflection under load P.

By inspection of Fig. 1 and formula (a) it becomes evident that the fiber stress is greatest in the coil of largest diameter. Hence, to get the load P that a conical spring will carry without exceeding a certain fiber stress, substitute D_1 for D in formula (a) or

$$P = \frac{\pi d^3 S}{8 D_1} \qquad (c)$$

In determining the deflection, account must be taken of the variable mean diameter. To do this, formula (b),

$$f = N \frac{\pi D^2 S}{G d}$$

can be used provided S is eliminated by substitution of its equivalent derived from formula (a) or

$$S = \frac{8 P D}{\pi d^3}$$

From this is obtained:

$$f = N \frac{\pi D^2}{G d} \times \frac{8 P D}{\pi d^3} = N \frac{8 P D^3}{G d^4} \qquad (d)$$

Applying this latter form to a conical spring, D being the only variable, the problem is to find an expression for the average value of D^3. This is done in the following manner:

Referring to Fig. 2 let the line $a\,b$ represent the value of D^3 as D varies from D_2 to D_1. The average value is gotten by finding the area of the figure $a'\,a\,b\,b'$ and dividing by its base $a'\,b'$.

Integrating between the limits D_1 and D_2 the area of the figure is

$$\left(\frac{x^4}{4}\right)_{D_2}^{D_1} = \frac{D_1^4 - D_2^4}{4}$$

Now the length of the base $a'\,b'$ may be expressed $D_1 - D_2$ whence the average height of the figure $a'\,a\,b\,b'$ is found to be

$$\frac{D_1^4 - D_2^4}{4 (D_1 - D_2)}$$

which is the average value for D^3 of equation (d).

The formula for the deflection of conical springs then becomes:

$$f = N \frac{8 P}{G d^4} \times \frac{D_1^4 - D_2^4}{4 (D_1 - D_2)} =$$

$$\frac{2 N P}{G d^4} \left(D_1^4 - D_2^4\right) \qquad (e)$$

which can also be written

$$f = 2 N P \frac{D_1^3 + D_1^2 D_2 + D_1 D_2^2 + D_2^3}{G d^4} \qquad (f)$$

It will be observed that when $D_1 = D_2$ equation (f) reduces to equation (d) or the formula for a cylindrical spring. This would be expected as this is the limiting condition of a conical spring. It is evident that the deflection of a conical spring is less than that of a cylindrical one whose diameter is equal to the maximum on the conical spring and more than one whose diameter is equal to its minimum.

In the design of conical springs care must be taken to keep the larger coils far enough apart to prevent them from setting solid before they should. If a spring is wanted such that the deflection shall decrease rapidly with increase in load, this can be accomplished by spacing the coils so that the larger ones set solid before the smaller ones.

Acme Threads Usually Better Than Dead Square

A prominent machine-tool builder recommends a modified form of the acme thread rather than dead square, as the methods for the latter require special alterations to thread millers. Unless an end mill is used, it requires three cuts to cut square threads: (1) Roughing the central portion, and (2) and (3), finishing the sides with special cutters.

Reducing Rates by Preventing Fires

The Committee on Insurance of the American Electric Ry. Association, at the convention of 1911, rendered a report on the subject for which it was appointed to investigate, in which it was stated:

So far as the committee has been able to ascertain, the insurance companies have not been called upon to pay one dollar in the past year on account of a fire in any car house or other buildings equipped with automatic sprinklers. You who have protected your buildings with automatic sprinklers may use this statement as an argument for reduced rates; you who have not protected your buildings may use it as an argument for so safeguarding your buildings as to prevent fire.

The tin used for alloys may be of two classes, known to the trade as grain tin and block tin; both are received in ingot or pig form. The grain tin is the highest grade. In adding tin to copper care must be taken not to get it too hot, or the tin will take fire and burn. The copper is melted first and then the proper amount of tin added. Some founders prefer to melt the large pigs of tin and pour them into small ingots of suitable size for adding to the alloys, while others saw or cut the tin into pieces of suitable shapes and sizes.

Methods and Tools in a Press Shop

By F. A. Stanley

Boring power-press bearings in a St. Louis shop on a home-made machine adapted for all sizes of frames.

Special press tools for making tool-steel straps, and for manufacturing belt fasteners without waste of material.

An outfit of punches, dies and other tools for making and assembling tin funnels composed of three parts.

The Fred J. Swaine Manufacturing Co., of St. Louis, Mo., uses a variety of interesting methods in making machinery, presses, and dies for working sheet metal.

The production of press tools for all kinds of operations is an important branch of this firm's business, and some of these sets of dies when completed present unusual and interesting features of construction. Several views of special punches and dies likely to be of interest are included in this article. They are reproductions of photographs obtained during a recent visit to the Swaine plant.

A Home-made Boring Machine

Fig. 1 illustrates this company's method of boring press frames on a home-made horizontal machine adapted for receiving all sizes of work, from the smallest to the largest press frame turned out by this shop.

The machine is made up of a floor plate with an extension at the left upon which is supported a low column carrying a vertically adjustable head from an old machine, and in which the spindle for the boring bar is mounted. At the left is a suitable outboard support for the bar, and the range of adjustments between the head and tail support is sufficient to cover all requirements for the different sizes of frames.

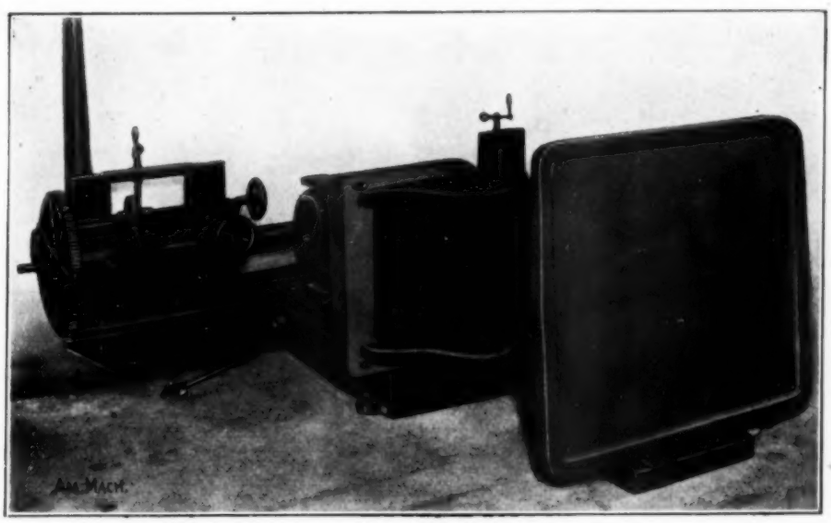


Fig. 1. Boring Power-press Frames on a Home-made Machine

The machine is served with a crane that travels directly above it, and the base plate being but slightly above the floor, it is a simple matter to place the work in position for boring out the bearings and easily remove it when the operation is completed.

The guides in the press frame are planed out before the frame is brought to the boring machine, and the planed surface is then used in squaring up the frame on the base of the machine before starting boring operations. Double-end cutters are employed in the bar and two cuts are taken with roughing cutters, after which a finishing cutter is passed through. The spindle is driven by a four-step cone at the rear and by the gearing shown at the left of the head. The feed is by the spur and worm gearing in front.

Dies for Tool Steel Straps

The press tools shown in Fig. 2 are of the pillar or sub-pressed type and were constructed for piercing and cutting off tool-steel straps which were required in various lengths, with different numbers and sizes of holes.

The view of the punch shows the piercing and shearing tools, and the method of inserting in the block. The die is provided with an adjustable stop-gage to give the desired length of strap, and the piercing dies near the end where the metal is sheared off, are formed by boring a series of holes in the rectangular block *A* which serves also as the lower shearing die.

This tool-steel die block is adjustable crosswise of the main die block to bring any one of the half dozen piercing die holes into alignment with the punch. This feature allows the die to be reset as each hole wears large, and also permits two different sized holes to be punched at the ends of different straps as required, as three of the holes in the die block are one size and the alternate three of another diameter. The dies for the other holes in the strap are formed by inserting bushings in the main die block. These are readily replaced as they become worn.

Belt Fastener Dies

The tools in Fig. 3 are for manufacturing the steel six-pronged belt hook shown in this view and also in Fig. 4. The tools are so designed that there is no waste of material except the small quantity punched from the center of each blank in forming the oblong opening. The die is made in sections which are fitted together at an angle corresponding with the side of the hook, so that as wear occurs the contact faces of the die sections may be ground off and drawn together to preserve the original position of the cutting edges.

The stock is about $\frac{1}{8}$ inch wide by $\frac{1}{16}$ in. thick. The first stroke of the press after the material feeds between the tools, stamps the name on the blank stock and the next stroke punches the small hole at an angle with the edge. At the left of the piercing punch *B* there is a pilot or locating punch *C* which, as the stock makes its third and all following advances, positions the strip properly for the subsequent piercing and shearing operations.

The Stock-feeding Device

The feed is incorporated in the die and consists of the oscillating lever *D* with a detent for engaging the hole punched in the stock, and a wedge-shaped operating arm *E* attached to the punch holder, which at each descent of the press ram, forces the feed lever *D* forward and feeds the strip of material one step ahead. The forward movement given the stock feed does not carry the material exactly to the point desired, as this correct location for the strip is secured by the tapered-end pilot *C* which enters

the opening in the strip after the feed lever has advanced it approximately to position. On the up stroke, the pilot rises out of the way with the other members in the punch block, and the wedge *E* then permits the feed lever *D* to swing back and engage the next hole in the steel strip.

The Splitting Dies

The knife that splits the stock to form the prongs of the belt fastener, is the double-edged tool *F*, which starts operations on the work at a point three steps removed from the pilot punch. This extra distance is allowed between the tools to give sufficient space for the proper construction and assembling of the sections constituting the punch, and also to provide ample space for the operation of the feeding attachment for the stock.

The first stroke of the punch *F* on the work results in the slanting cut from each edge seen in Fig. 4 at *G, G*. It should be stated here that this view shows the material as it appears from the underside after passing through the dies, and, therefore, the slope of the gashes in the stock is directly opposite what it would be if viewed from the top. In other words, in order to indicate the sequence of operations as clearly as possible, the strip of steel has been photographed in a position to harmonize with the punch as shown face up in Fig. 3.

The Finishing Cuts

The next advance of the stock allows the opposite edge of punch *F*, Fig. 3, to cut the second pair of slits *H,H*, Fig. 4, and then the work is fed three steps (to gain space as before) before the shearing punch *I*, Fig. 3, cuts off the blank along the line *J*, Fig. 4, thus finishing the last prong on the blank, which is cut off, and the first one on the next blank which is still attached to the strip of material. The three following strokes of the press carry the severed blank with its six sharp prongs under the forming punch *L*, Fig. 3, which pushes the work through the corresponding die, bending up the prongs and discharging the finished belt fastener from the press. Each subsequent stroke then completes a fastener.

From the foregoing description, it will be seen that thirteen distinct feeding movements transpire in passing any point on the stock through the complete series of dies. Once the material has reached the forming die, however, each stroke of the press completes a fast-

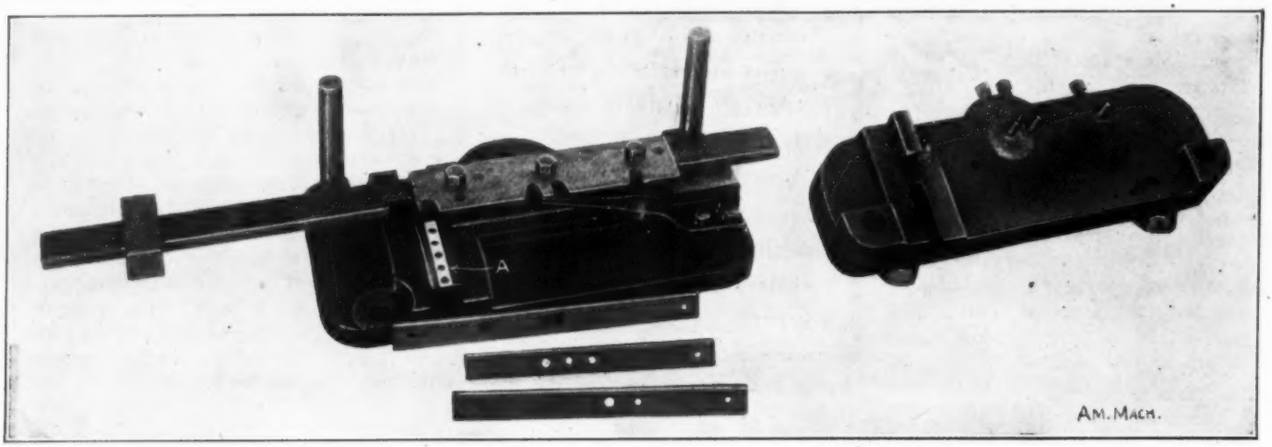


Fig. 2. Punch and Die for Piercing and Cutting Off Steel Straps

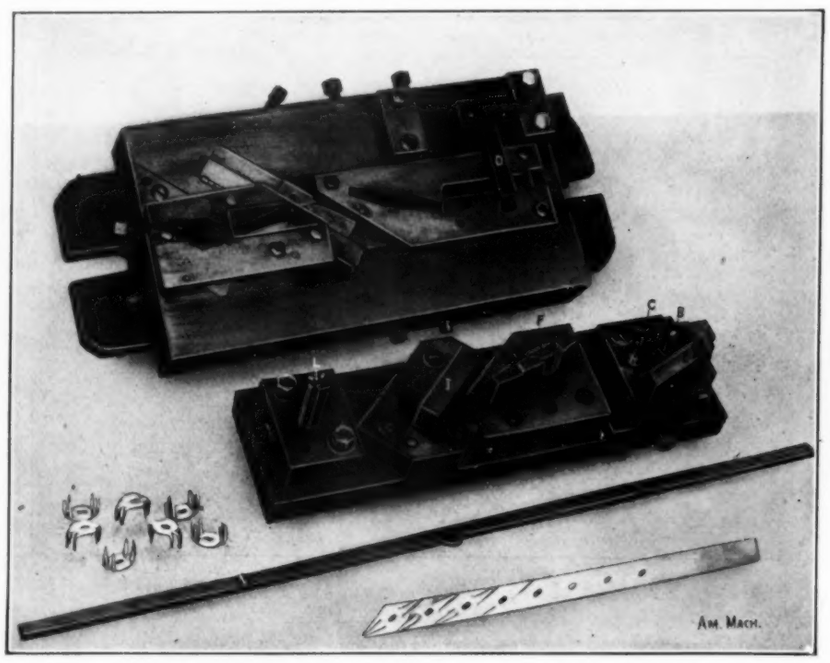


Fig. 3, Press Tools for Making Belt Fasteners

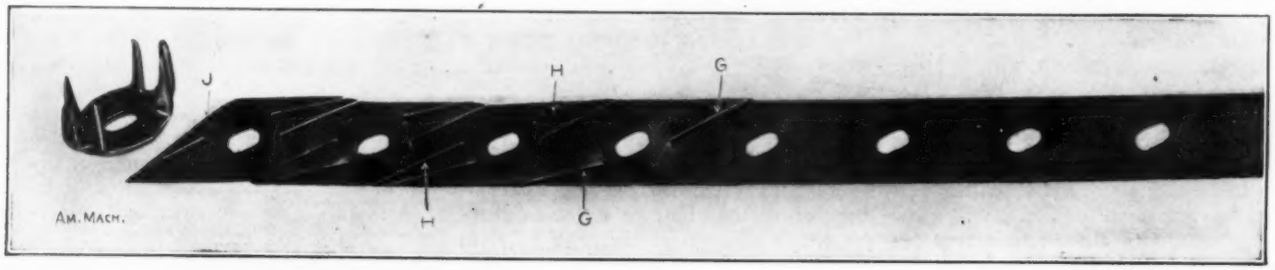


Fig. 4. How the Belt Hook Is Made with Practically No Loss of Stock

ener and discharges it from the dies, and the rate of production is about 100 pieces per minute.

Tinware Dies

This same company has also devoted much time to the development of tools for manufacturing tinware in large quantities, and some apparatus for work of this nature is illustrated in Figs. 5, 6 and 7.

The article produced with these tools is a tin, funnel-shaped member, shown at the lower right-hand corner of Fig. 7. The use of solder is entirely obviated. It is made up of three prieces, namely: Body, breast and collar. The first two are of conical form but of different taper, the latter are cylindrical.

The body and breast are blanked out with the dies shown in Fig. 5. These are made up of tool steel welded to a wrought-iron plate. They are properly cleared and sheared to cut freely, and the blanks produced are of the form shown in the foreground of the illustration.

The blanks are curved up for seaming, in power rolls, or, if desired, hand-power rolls such as are used by tinners could be employed for this work. A Swaine duplex folding and seaming machine is then employed to accomplish the seaming operation, after which the breast is ready for the attachment of the collar, which is made up with the tools illustrated in Fig. 6.

Making Tin Collars

The tin strip for the collar is cut to length and notched at the corners with the punch and die at *A*, Fig. 6. Then the blank is stuck into the bench die *B* and the ends turned over for the side seam. Next, one of the hooked ends is caught in the notch of the roll in the bench rolling machine *C*, where the strip of tin is wound up into a circle, by means of the hand crank, the pressure roll *D* holding the material against the main roll during the process. The tin rings are now hooked together at the ends and placed on horning die *E* in the press, where the seam is closed or "locked."

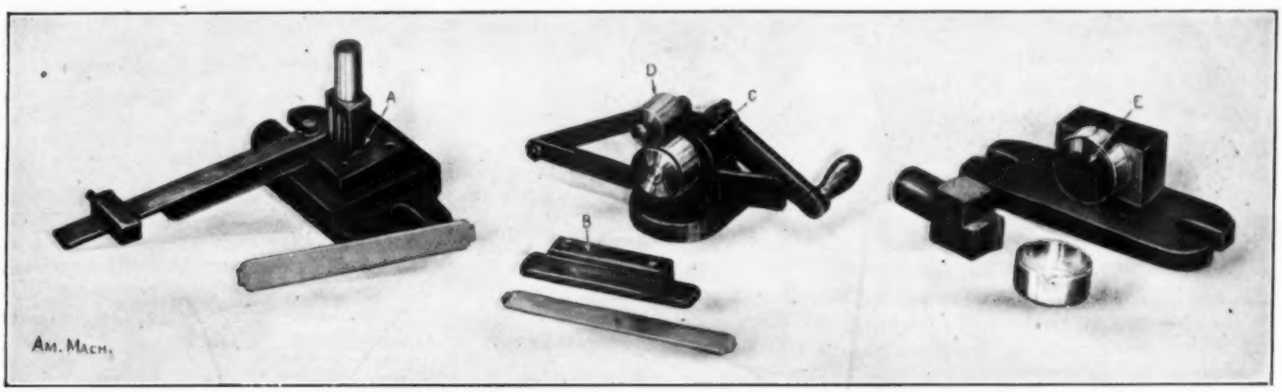


Fig. 6. Tools for Making Collars for Tin Funnels

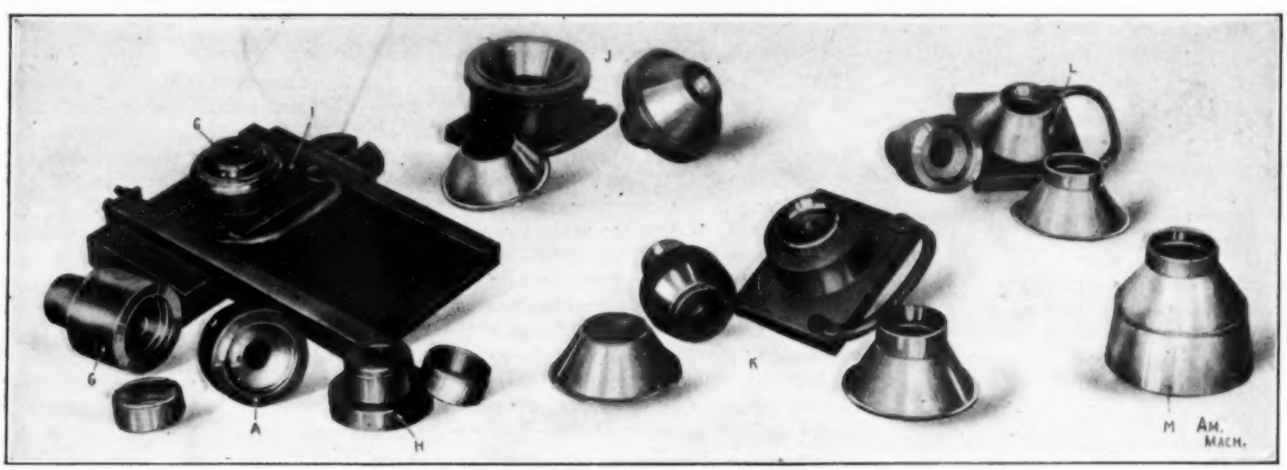


Fig. 7. Press Tools for Tin-funnel Operations

Other Press Operations

Referring to Fig. 7, the tools in group *F*, are next used for reducing the edge of the tin collar so that it will enter the small end of the funnel-shaped breast. Two sets of reducing dies are used, the first-operation tools being represented at *G,G*, the finishing tools at *H,H*. The roughing dies leave the edge of the collar wrinkled as at *G*, but the second-operation tools smooth out this neck as indicated at *H*, and size it accurately.

The two sets of dies are used in turn in connection with the sliding block *I* which fits nicely in the bolster *F*. The die block has an opening to receive the die proper and a handle to slide the die and work under the punch and withdraw it after the ascent of the ram. The operator's fingers consequently are never in danger of injury as the work is placed in the die and removed from it at a point several inches in front of the ram.

The sliding die block is positioned correctly for each stroke of the press by a stop screw at the rear against which it is pushed by the operator. A further safeguard sometimes applied consists of a device which is so connected to the foot treadle that the latter cannot be depressed to start the press until the die block is exactly in position under the punch.

Flanging and Assembling

The tools at *J*, Fig. 7, are used with the same bolster *F*. The breast is dropped into the die and upon the descent of the punch, the base of the cone-shaped work is flared out and the edge, at the

smaller end, is turned inward and sized to receive the reduced neck of the collar.

The assembling die is seen at *K*. The collar is slipped into a narrow channel between the outer die ring and the inside member, and the breast is then placed over the reduced, upper end of the collar. The punch in coming down clinches the edges of the two pieces and thus joins them firmly together.

The tools *L*, Fig. 7, are for "false wiring" the top of the collar, the metal being curled around neatly but without the insertion of a wire ring. The final operation is the joining of the breast to the body as at *M*, Fig. 7, an operation accomplished on a power, double-seaming machine with the work rotated in contact with a pair of rolls, one of which curls over the seam while the other flattens it as desired, fixing the two parts firmly and smoothly together.

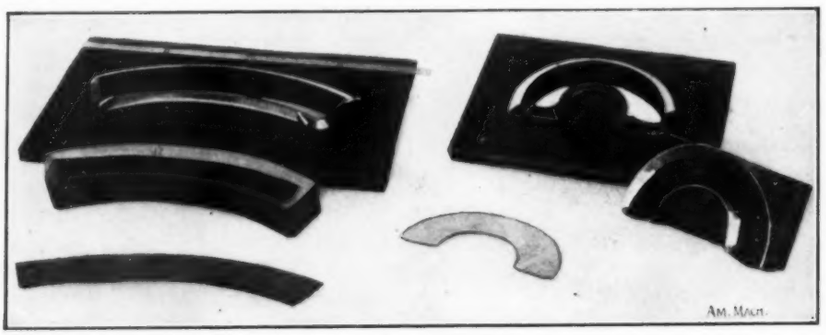


FIG. 5. BLANKING DIES FOR TIN FUNNELS

Wrought Iron Tap

BY JOHN A. COOK

This job was done in the days before machine steel became common.

An old wood-planer was being overhauled. The elevating screws were worn out and the threads in the crossrail were stripped. New screws were made of wrought iron a little longer than the old ones, and the ends were fluted like a tap and case-hardened.

WROUGHT-IRON PIPE

The holes in the crossrail, which was of cast iron, were then tapped out with these screws, and afterward the fluted ends were cut off from the screws. A first-class job was thus obtained.

There are few shops where the line shafting could not be improved and power saved by frequent and rigid inspection with the proper instruments by a man detailed for this and similar duty.

Piece Rates vs. Bonus

BY C. J. MORRISON*

The statement that a piece rate gives the workmen pay for all the time they save, while the bonus systems pay the workmen only part of the saving, has been made so many times in various publications, that a correction is called for. That such a statement should be so generally accepted as true is amazing. As the declaration that both piece rate and bonus systems reduce the burden charges per unit of output is so obvious that no demonstration is necessary, it will be accepted as true, and only labor costs considered.

If piece rates pay the workmen for all the time saved, how do piece rates reduce the labor costs of production? The claim is always made that such economies are effected. Therefore, the only answer to the question is that the workmen do not get all they save. Someone has been fooled and the company really takes part of the saving.

The various bonus systems differ only in detail, but, in order to avoid any controversy, the method employed by one concern only will be considered as an illustration. In a well regulated shop, where matters are properly handled, the methods of establishing either piece rates or standard times are identical. As a matter of fact, time is the standard in both cases, as a time study is the basis of either a piece rate or a bonus reward.

Assume that a time study has been made of a machine operation which has been taking three hours, and that two hours is decided upon as standard time. The workman is then instructed that he can perform the task in two hours. In a piecework shop a piece rate will be set. Will it be the man's wages for three hours? Never, for in that case the workman would receive all he saved and there would be no reduction in labor cost. More likely the price would be set for two hours, but assume that the employer is very liberal and the rate is set for 2.5 hours, or (assuming a rate of 30c. per hour) 75c.

*Manager, engineering department, Suffern & Son, New York City.

For purposes of comparison, consider the earnings for different times consumed in doing the work:

	PIECEWORK		BONUS	
Time, hrs.	Price	Rate per hr.	Wages and bonus	Rate per hr.
1.0	$0.75	$0.75	$0.72	$0.72
2.0	0.75	0.375	0.72	0.36
2.2	0.75	0.34	0.73	0.33
2.3	0.75	0.33	0.74	0.32
2.5	0.75	0.30	0.75	0.30
3.0	0.75	0.25	0.90	0.30

In this example, which was purposely selected as particularly favorable to the piece rate, there is very little difference in the amounts paid the workman. As the time consumed by the man becomes longer, the rates become nearer the same until at 2.5 hours they are identical, and beyond that point the bonus system pays decidedly more.

As a matter of fact, in setting standard times, the best a man can do by his utmost endeavors is never selected, but a slightly longer time determined by the nature of the work. In the case illustrated above, the standard time actually selected was 2.2 hours, and different workmen vary on the job from 2 hours to 2.3 hours.

Assuming the same liberality as before on the part of the piece-rate setter, and 2.2 hours as standard time, the comparison becomes:

	PIECEWORK		BONUS	
Time, hrs.	Price	Rate per hr.	Wages and bonus	Rate per hr.
1.0	$0.75	$0.75	$0.79	$0.79
2.0	0.75	0.375	0.79	0.395
2.2	0.75	0.34	0.79	0.36
2.3	0.75	0.33	0.80	0.35
2.5	0.75	0.30	0.81	0.32
3.0	0.75	0.25	0.90	0.30

The two cases amply illustrate the liberality of the bonus system and also show, what is far more important, the protection afforded the slower workman. Any accidents or other unavoidable delays are also automatically cared for, as the workman under the bonus system never receives less than his regular hourly rate.

Of course, it is possible to select certain isolated examples out of either system and prove almost anything desired, but the above are fair average examples. The points illustrated are that neither method pays all the saving to the workmen, that the bonus system gives the workmen a larger percentage, that it affords a better protection to the slower workman, and that it automatically takes care of all delays.

The tin used for alloys may be of two classes, known to the trade as grain tin and block tin; both are received in ingot or pig form. The grain tin is the highest grade. In adding tin to copper care must be taken not to get it too hot, or the tin will take fire and burn. The copper is melted first and then the proper amount of tin added. Some founders prefer to melt the large pigs of tin and pour them into small ingots of suitable size for adding to the alloys, while others saw or cut the tin into pieces of suitable size.

Sapphire Tools for Cutting Metal

By Herbert L. Thompson

Use of sapphire cutting tools and the way they should be ground for various purposes.
Fixtures and laps, speeds and feeds.
Slabbing out sapphires for tools, and the way to hold them.

Most mechanics who are accustomed to fine work, are familiar with the use of diamond as an abrasive and infinitely hard cutting tool; but very few know that the much cheaper and softer stone, sapphire, is of almost equal value if properly used.

Diamond, probably the hardest known mineral substance, cannot be cut by any other abrasive, so the process of grinding it to a cutting edge is immeasurably slow, and the production of some of the most desirable shapes is impracticable. The first cost of diamond is exceedingly high, and if it is necessary to have it shaped up into a cutting tool, that cost is added to alarmingly. It is scarcely less brittle than sapphire, either of them being far more likely to break or chip than grow dull with use, if ground to a cutting edge. If a diamond tool breaks, regrinding is a matter of at least hours, possibly days; but quite a large sapphire tool can be ground in five minutes. A soft steel or copper lap charged with diamond dust will cut sapphire as fast as it would steel, and any reasonable shape can be produced.

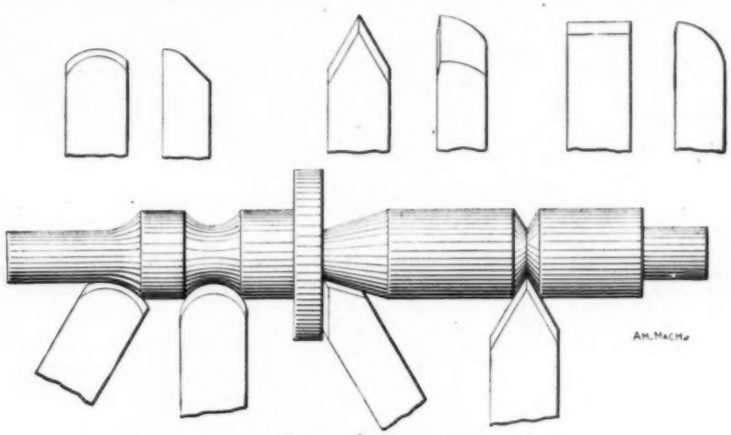


FIG. 1. SHAPES OF SAPPHIRE TOOLS

It is often desirable to finish the outside of small round steel parts after hardening, to insure absolute accuracy and truth, and where there are no shoulders nor intricate shapes, grinding answers all purposes, but as it is only the plainest shapes that can be ground, it is customary either to trust to luck in hardening or make a clumsy-looking piece to facilitate grinding. Watch balance staffs, pinions, jewel settings, screws and arbors, small punches, taper, dowel pins, hardened lathe centers, and in short, almost any kind of small work can be finished with sapphire; it matters not if the metal is hard or soft, if proper care is used.

CUTTING HARDENED STEEL

A sapphire tool correctly shaped and well polished, will cut absolutely glass-hard steel; it will cut it rapidly, leaving a fine smooth surface, and remarkable as it may seem, it will produce a chip that will curl into a beatifully burnished helix, tough enough to hold together for a length of several inches if the feed is constant, though a very slight pressure will crush it almost to dust. With a correctly shaped tool, even a very shallow cut will give a flaky chip with a tendency to curl, and the tool will be in bad shape indeed, before it will produce the powdered chip that is common with the diamond when turning hardened steel.

It is possible to force sapphire on hardened steel, until the chips come off blue, but it will generally result in a chipped tool edge before long. A piece of hardened steel must be round and fairly true in order to turn well with sapphire, and if there are transverse holes or flutes in the piece, they are likely to break the tool edge if not very carefully handled. A chipped edge on a sapphire tool is not such a serious thing, however, as it can be reground almost as easily as a steel tool can.

SHAPE OF THE TOOLS

The shape of a sapphire tool is probably the most important factor contributing to its efficiency for cutting metal; it must be very different from the shape of a steel tool for the same purpose. Most important of all, the clearance on a sapphire tool should be a curve, not an angle, if maximum service is expected. Also, the amount of clearance should be very small. In fact, a sapphire tool properly ground to turn the outside of a round piece of work appears altogether too blunt to cut at all. The top of the tool should be chamfered toward the edge just enough to insure against hogging; one or two degrees is sufficient, and, both the chamfer and clearance must be polished as highly as possible. Fig. 1 shows a number of different shaped tools and their application to the work.

FINE FINISHING VARIOUS SUBSTANCES

For producing a fine finish on aluminum, hard rubber, fiber, brass, oreide, copper and gold, sapphire is unapproachable as it will cut at a high surface speed and will not wear away as a steel tool does on hard rubber or fiber. For turning aluminum, kerosene should be used with the sapphire, but on steel either hard or soft, no lubricant seems to help, and oil prevents the proper bite of the tool. Gold, brass and oreide work much better if the sapphire is wet with saliva, for which there appears to be no substitute. For a particularly fine polish on the last named metals, the tool should be ground to the correct shape, highly polished, and fed into the work as a form tool. It will improve matters if the surface speed is very slow for the last three or four revolutions.

Sapphire is not to be recommended for any kind of roughing work, as it is entirely too brittle, but for a test, a piece of drill rod $\frac{1}{8}$ inch in diameter was hardened as hard as possible, and after chucking it in the bench lathe, four cuts across reduced its diameter to 0.052 inch. The tool was given all the depth of cut it would stand, but as the feed was slow it was not injured in the least by the heavy cut. The lathe speed in this instance was 1600 revolutions per minute, and the sapphire was a round-nosed tool $\frac{1}{16}$ inch square and $\frac{1}{2}$ inch long, fastened into a slot in a lathe-tool shank with shellac.

POLISHING SOFT METALS

For securing a fine polish on the softer metals, very little stock should be removed with the sapphire; a roughing tool of steel to precede the sapphire and bring the work almost to size, being a necessity if much work is to be done. A heavy cut in soft metal does not hurt the sapphire, but it causes the metal to stick to the edge of the tool in a thin film which will spoil the polish. As many as ten thousand polishing cuts can be made on brass wire $\frac{1}{8}$ inch in diameter,

at one grinding of the tool, provided that the surface speed is slow, the cut light and the sapphire well lubricated with saliva. A surface speed of two feet a minute will give a beautiful polish on brass if the other conditions are right. The white of an egg, or commercial albumen dissolved in water, makes a fair substitute for saliva as a lubricant, but it is also hard to handle and unpleasant to use.

Grinding the Sapphires

A disk of soft steel or copper, charged with diamond dust, makes an excellent lap for grinding a sapphire tool. The diamond dust should be of medium grade and rolled into the lap with a hardened-steel roll. All oil must be removed from the face of the lap before grinding is attempted, and water in plenty must be supplied to the cutting surface while grinding. A soft moist sponge on the end of a stiff piece of wire, is excellent for feeding the water. If the lap becomes dry for an instant, the edge of the sapphire is almost sure to chip and score the lap, which will make it necessary to re-turn the lap and recharge it with diamond dust, before nice work can be done on that part of the lap again. The charged surface of the lap must run absolutely true with the spindle, so as not to pound on the sapphire while grinding, and the position of the tool against the lap must be such as not to produce chatter. The surface speed of the lap at the cutting point should be about 1250 feet per minute.

Polishing the Sapphires

For polishing the sapphire tool, a boxwood lap is all that could be desired; tin, hard rubber and fiber laps are successfully used at times, but they are unequal to boxwood for cutter work. The boxwood should be as hard and and close grained as possible, and cut so that the grain will be parallel to the axis of the finished lap. It should be charged with the finest diamond dust it is possible to procure. The dust that finally settles in the olive oil that has been used for grading diamond, is ideal for polishing small finishing tools.

Tools for work on steel can be polished with diamond dust as coarse as No. 3, and, if the finest dust is not obtainable, a softer piece of boxwood for the lap, will give a fair polish with coarser dust. Too soft a lap, however, will tend to round the corners of the tool too much, and produce a deceptive clearance. The fine diamond dust for the polishing lap should be mixed with a large proportion of olive oil and spread on the lap with a rather stiff spatula. Rubbing and rolling are not necessary to charge a boxwood lap, as capillary attraction will draw the dust back into the wood with the oil. A lap surface speed as high as 1800 feet per minute is desirable for polishing, and the cutting surface of the lap should be kept moist with olive oil.

Shaping

A skillful workman can produce most of the desirable shapes for sapphire tools, by simply holding the tool against the lap by hand, but in manufacturing operations where the sapphire is probably most valuable, it is absolutely necessary to have some kind of a fixture to reproduce the shape. Especially where the sapphire is used for polishing is it necessary to be able to duplicate the shape of the tool absolutely, as the slightest change in clearance will cause a great difference in the surface secured.

The Fixtures Used

Fig. 2 shows three views of a simple and inexpensive device for grinding and polishing sapphire tools of various shapes. The illustrations show the fixture in its simplest form—for hand operation of the shaping mechanism—but it can readily be elaborated to become semi-automatic and entirely power driven.

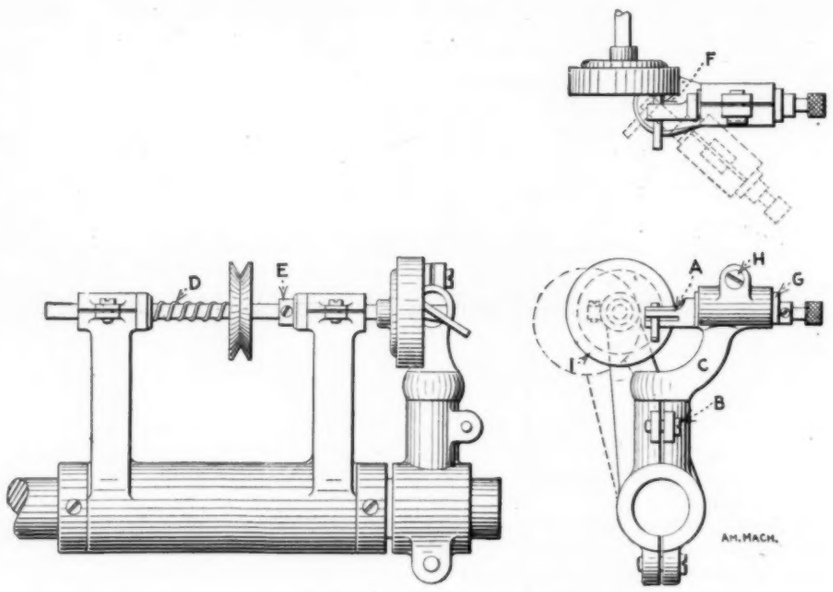


Fig. 2. Devices for Grinding and Polishing Sapphires

The sapphire slab upon which the tool is to be ground is cemented into the slot in holder *A* with shellac, at any angle to the axis of the spindle of the holder that the shape of the required cutter calls for. If a simple straight-edged tool with only a rounded clearance is wanted, the binding screw *B* is tightened on the spindle of *C*, and the holder is revolved back and forth through an arc sufficiently long to grind the clearance on the cutter. The lap is fed to the work by the coiled spring *D* on the lap spindle, and the radius of the clearance curve is determined by the stop collar *E*, which banks against the front bearing of the spindle. The radius of the clearance curve is always equal to the distance between the face of the lap and the center of the spindle of holder *A*, and it can be maintained or changed, by maintaining or changing the position of the stop collar *E*.

For grinding round-nosed tools, the binding screw *B* is loosened and while the holder is oscillated as before, the bracket *C* is also swung on the center *F*, thus producing both curves. The adjustment in and out of the holder is accomplished by moving the whole eccentric bushing *G*, which is locked in position by the binding screw *H*. The eccentric bushing *G* may be turned to adjust the relation between the center *F* and the center of the spindle of holder *A*, so that any reasonable combination of clearance and top curves can be obtained.

In polishing the tool the grinding lap and spindle are removed from the head by means of the split bearings, without disturbing the position of the stop collar; the polishing lap and spindle are put in their places, and if the stop collar on the polishing lap spindle has been previously set to correspond with that on the grinding spindle, polishing can begin at once. To obtain the best results the stop collar on the polishing lap should be set so as to just touch the sapphire with the lap; otherwise, the corners of the tool will become unduly rounded and thus spoiling the shape.

The whole head of the fixture must swing while in use, to break the lines on the ground surface, and provide for the use of the whole charged surface of the lap, as shown by the dotted lines at *I*. The motion can be imparted to the head

by hand, or by a cam or crank motion, depending on the amount of work there is for the fixture.

The difference in speed in grinding and polishing is provided for by the corresponding difference in the diameters of the grooved driving pulleys on the grinding and lapping spindles, and as each spindle carries its own coiled spring, that also can be adjusted to the requirements of the particular lap it is used with.

Changing Laps

When changing from grinding to polishing laps, the tool should be carefully cleaned to remove any coarse diamond dust, but it must not be moved from its position or the polishing lap will not follow the same form that the grinding lap did. The least bit of coarse diamond on the polishing lap will cause it to scratch and spoil the polish, but the same care is altogether unnecessary with the grinding lap. The chamfer on the top of the tool is most easily made by hand on the polishing lap. It is not a very particular operation and will be found quite simple, with a little practice.

Holding the Sapphires

While grinding, and while in use, it is preferable to shellac the sapphire into whatever holder is used. For light polishing cuts it is possible to hold the tool very well with a clamping fixture, but if the work is at all severe the additional work of cementing the tool into a slot, will more than pay for itself in better work and fewer broken sapphires.

When grinding or polishing sapphire, one must never crowd the work hard against the lap; it breaks the diamond out of the lap and scores the surface, spoiling the lap for further use almost at once. A good lap properly charged, and lightly used with plenty of water, will grind a greater number of sapphires in fast time, and the expense for diamond dust will be very small.

Making Slabs for Tools

Sapphire slabs of good enough quality for tools can be bought ready cut from some lapidary, but if the mechanic wishes, he can easily slab up his own stone from the rough. A "saw" is made of a thin disk of copper or tin plate clamped firmly between two stiff disks of steel or cast iron, and mounted on an arbor in the lathe. The edge of this saw is charged with coarse diamond, and it will work at its best if submerged in water while running.

The rough sapphire is cemented with shellac to a flat plate which can be accurately fed to the saw, and the stone can be cut almost as fast as a piece of steel of equal size. After cutting the rough stone up into slabs of the required thickness, each slab is in turn cemented to the flat plate and sawed again into oblong pieces the proper size for the tools. The oblong pieces will be somewhat rough and irregular as they come from the saw, so, if a real nice tool blank is required, one more operation will be necessary to produce a perfect one.

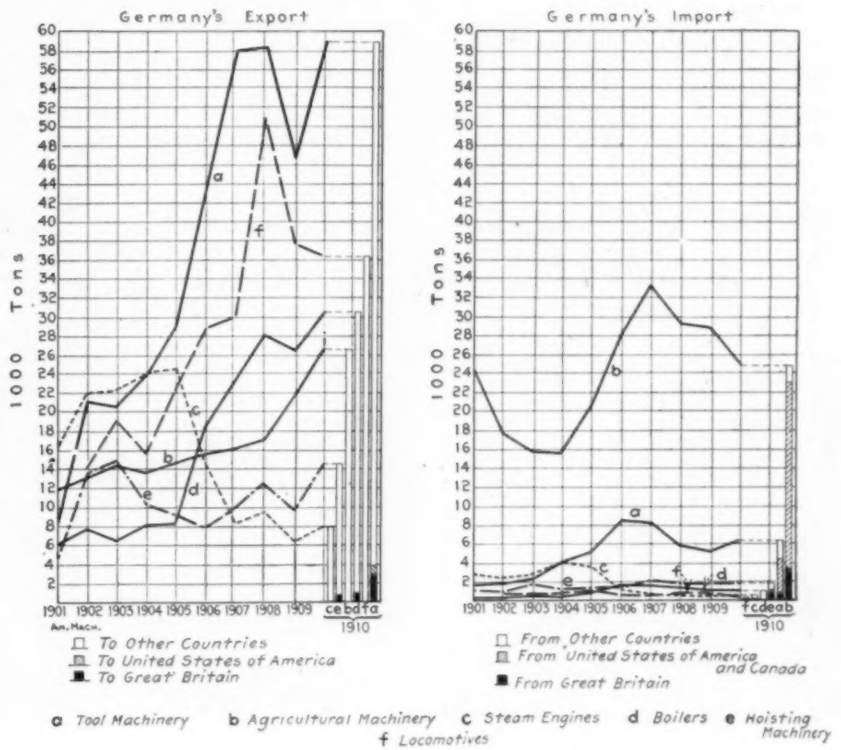
Cement as many of the rough blanks to the flat plate as it will hold, laying all of them in the same position, so that the side to be finished will be up. You can now hold the plate in your hand and grind the upper surfaces of all of the oblong pieces against the flat face of the lap until they are perfectly flat. By recementing them to the flat block in the different positions, all of the sides can be treated alike, and if a polished tool blank is wanted, it is a simple matter to follow each grinding operation by a similar one on the polishing lap. A tool blank of this kind, ⅛ inch square and ¾ inch long, is strong enough for all ordinary work, and the cutting edge can be reground repeatedly until it is too short to hold.

It is not generally known that sapphire can be used for turning metals, especially hardened steel, but as it is reasonably cheap and the making of the tools is not difficult, it will pay anyone who has work of this kind, to give it a trial.

The one-millionth patent was issued on Tuesday, August 8, 1911, by Patent Commissioner Moore in favor of Frank H. Holton, of Akron, Ohio, covering an improvement on inflated automobile tires.

Exports of German Machine Tools

The two accompanying charts are reproduced from *Zeitschrift des Vereines Deutscher Ingenieure,* and were originally presented in a paper read before the *Verein Deutscher Maschinenbauanstalten* by Dr.-Ing. G. Schlesinger. The first shows the amazing growth of Germany's exports of machine tools in the period 1901 to 1910, inclusive. During the first year of this period the total was only 8500 metric tons. In 1908 it reached 57,300 tons, and in 1910, 57,500 tons, an increase in nine years of nearly 50,000 tons, an enormous growth.



Germany's Exports of Machine Tools

The second chart shows Germany's imports of machine tools during the same period. There has been a decided drop since 1907; but the United States holds the lead among the nations from which the imported machines come. The charts also show German exports and imports of agricultural machinery, steam engines, steam boilers, hoisting machinery and locomotives.

A part of the important work carried on by the American Museum of Safety consists in the distribution of what are known as safety leaflets. Two of these leaflets, dealing with the safeguarding of presses and punches, and safety devices for the molder, have already appeared, and others are in the course of preparation. The leaflets show in concise illustrated form worth-while safety devices.

Horn Comb Finishing Machines

Editorial Correspondence

Grinders of various kinds for finishing combs.

An automatic machine for sharpening small steel burrs; a continuous-running assembling press; a tooth-sawing machine with a novel cam feed; method of sharpening saws on their own arbors and the device used for removing the burrs.

In a previous article we described the manufacture of horn combs, as carried on in the factory of the Noyes Comb Co., Binghamton, N. Y., from the time the rough horns were brought into the factory until they were run through the tooth-cutting machine, and in the present article the subject will be continued by describing some of the machines used in relation to the finishing processes.

Of course, all the combs sent through the factory do not go through exactly the same process, as there is a great number of styles and shapes, some of which requiring considerably more work than others, according as they are burred or beveled between the teeth, have grooved backs or are just plain, but in a general way the method of procedure is along practically the same lines.

FIG. 1. EDGING MACHINE FOR GRINDING BACKS

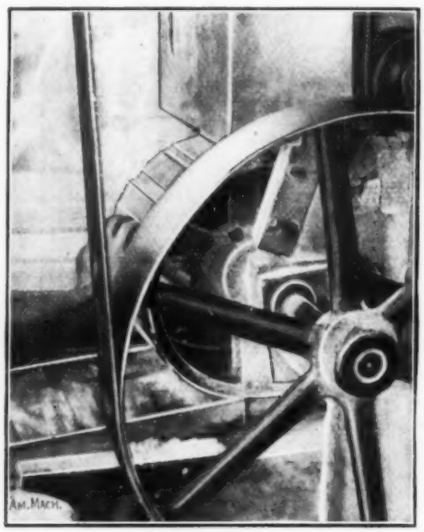


FIG. 2. GRINDING SIDES OF DRESSING COMBS

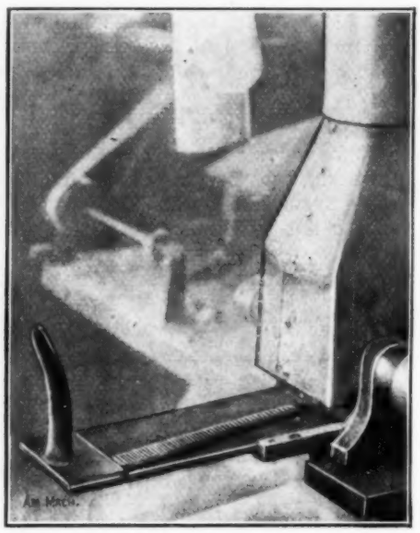


FIG. 3. SLANTING MACHINE FOR THINNING ENDS

GRINDING THE COMBS

The backs of straight-back dressing combs for a certain lot, are all ground a uniform size and given a slight radius in the machine shown in Fig. 1, the combs being dropped one at a time by hand into the slots in the revolving cylinder *A*, which travels in the direction shown by the arrow, and feeds the combs past a sandpaper wheel which revolves in the direction shown by the arrow on the dust hood. The combs drop out by gravity as the cylinder turns.

The sides of these combs are ground and the teeth all given the same taper in the machine shown in Fig. 2, the combs being laid in shaped recesses in the rim of the cylinder, so that they are fed, teeth first, under a sandpaper wheel and drop into a chute beneath. Barber combs are thinned on the small end by placing them on a sliding carriage and feeding them under a sandpaper wheel, as shown in Fig. 3, the device being known as a slanting machine.

It will be noticed that all of these comb-grinding machines are carefully hooded, which is done not only as a matter of health for the workers, but also for the saving of the powdered horn, which is used for fertilizer, case-hardening and other purposes.

GRINDING SMALL BURRS

Some of the teeth are beveled, or burred, as it is called, to an almost diamond-shaped cross-section in an automatic milling or burring machine, which uses small cutting burrs about ¾ in. in diameter. These burrs dull rapidly, and so the automatic grinder shown in Fig. 4 was made. This grinder is made to

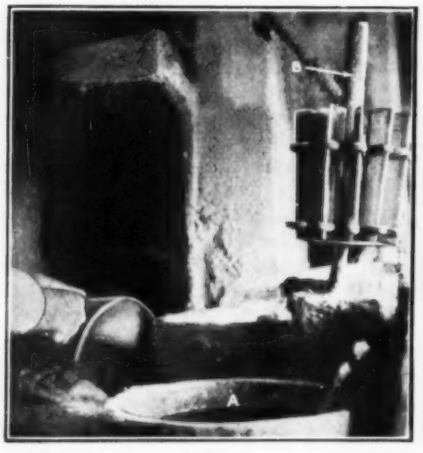


FIG. 5. POLISHING ON A CARPET WHEEL

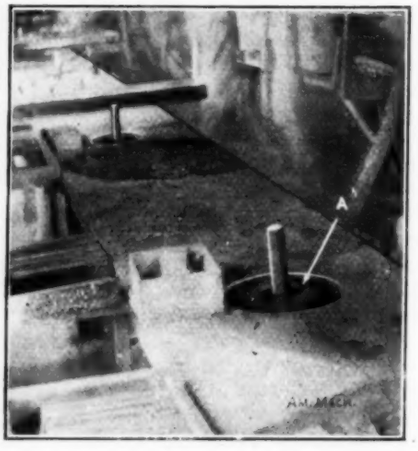


FIG. 6. DRYING IN A DRAFT OF AIR

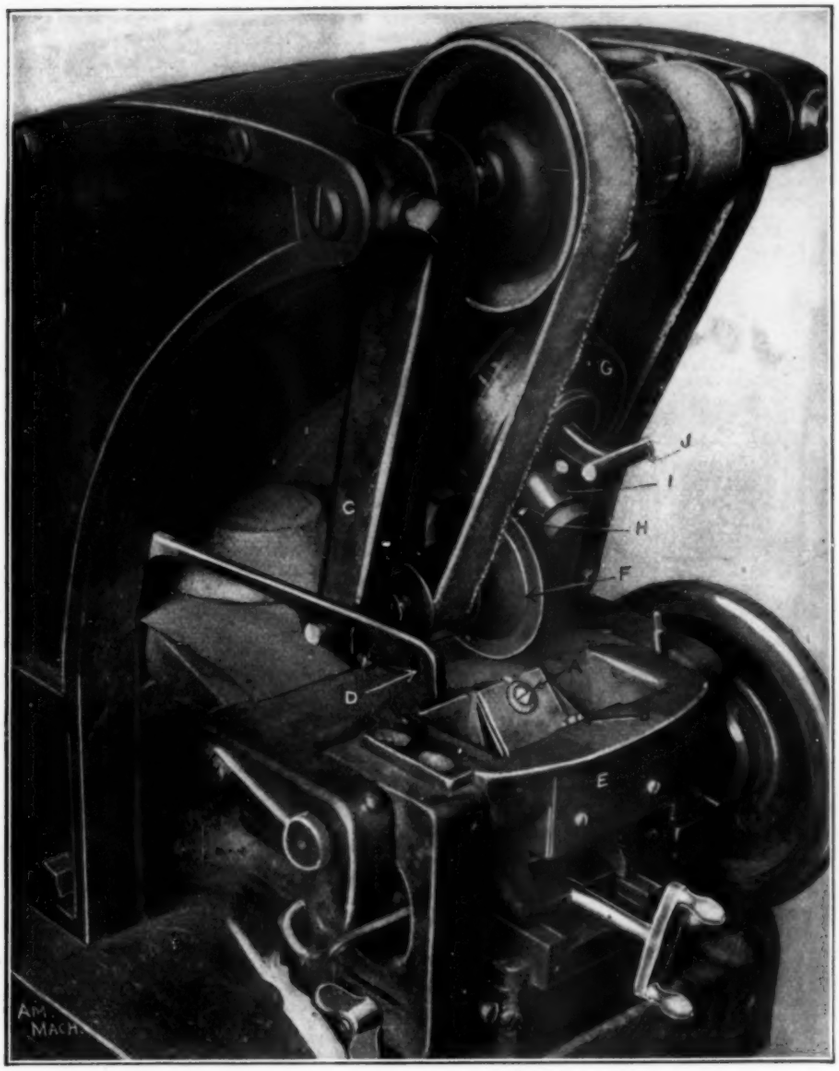


FIG. 4. GRINDER FOR SHARPENING THE BURRS USED TO BEVEL COMB TEETH

grind two burrs at once, the burrs being screwed onto indexing spindles at *A* and *B*, which are set at an angle to each other, so that when the swinging grinder head *C* is set into notch *D* and the carriage *E* raised, the grinding wheel *F* will strike between the teeth on the lower edge of the burrs. The carriage *E* automatically works up and down and indexes the burrs, so that when properly set they are quickly and accurately ground.

An interesting feature of this machine is the wheel-truing device at *G*, for in order to grind the teeth of the burrs, the periphery of the wheel must be of a V-section, which is obtained by having a diamond set into the holder *H* mounted in the post *I*, which is set into a slide operated by the handle *J*. This slide is made so that it may be swung to the right or left sufficiently to cause the diamond to dress the wheel the correct angle when it is fed down onto it by means of the handle *J*, one edge being dressed and the slide swung over to the opposite side and the other edge finished, the result being a true running wheel of the proper shape. The belts used on this grinder, as well as those used on a number of other small, speedy machines in this shop, are of felt, or what is commonly known as printer's blanket.

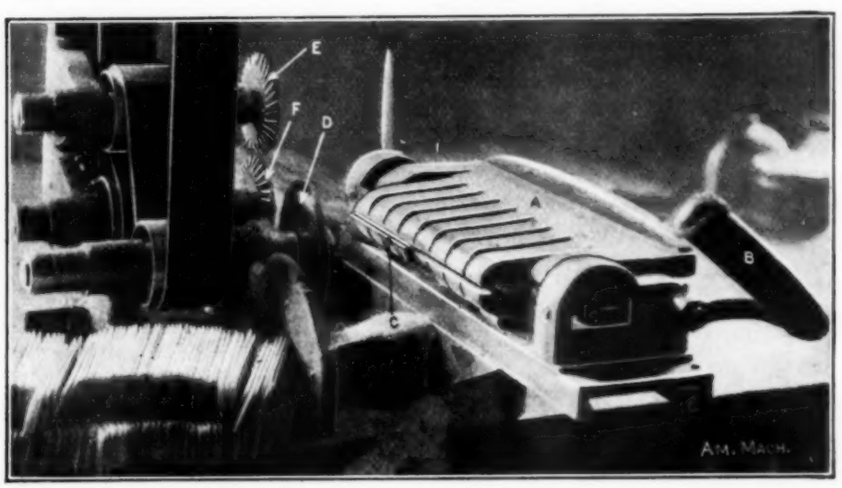


FIG. 7. TRIMMED AND GROOVING FOR METAL BACKS

FINISH POLISHING THE COMBS

The final high polish is given to the combs on carpet wheels, as shown in Fig. 5, using wet clay as the polishing element. As the combs are polished they are rinsed off in tank *A* and placed in the circular rack *B*, which holds 12 combs. As soon as 12 combs have been polished, which takes but a few minutes, the rack is lifted off the pin on which it is set, and placed on a revolving spindle at *A*, Fig. 6, inside of the long drying box *B*, through which a steady current of air is forced by a fan, the object being to thoroughly dry the combs before the water has a chance to warp them. The principal damage from warping would be done, not by the whole comb being wet, but by a few drops that might remain between the teeth. As soon as the combs are dry a boy removes them, places them in trays and returns the racks to the polishers.

GROOVING FOR METAL BACKS

Narrow-backed combs are trimmed and grooved for metal backs in the machine shown in Fig. 7, the combs being placed teeth inward against a gage in the jaws of the vise *A*, which is operated by a cam and lever *B*, the back of the comb projecting as at *C*. The vise and carriage is then pushed forward by hand, the saw *D* trimming the back to size and the two mills *F* and *F* cutting a groove on each side. As both the vise and slide are worked by the same lever, the operator can do very rapid work, as the trimming and grooving are done about as fast as a man can push the carriage to the cutters.

PUTTING ON METAL BACKS

The channeled and shaped metal backs are made of aluminum, nickel-plated brass or a composition known as nicolene, and are formed in a punch press ready to have the grooved combs slipped into place in them, after which they are

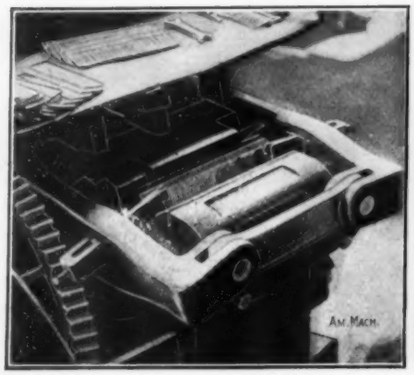


FIG. 8. ASSEMBLING PRESS OPEN

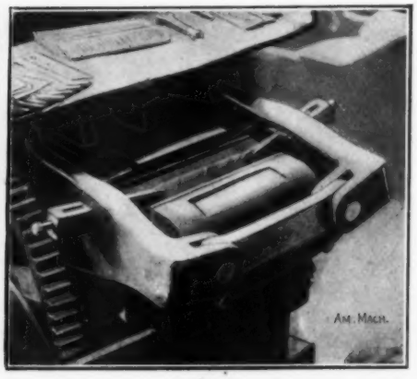


FIG. 9. ASSEMBLING PRESS CLOSED

the handling of the comb, and also that the blank may be fed straight onto the saw by the rocking movement of the carriage *E*, which is given it by means of the threaded cam *F*, which engages a 30-thread lead screw, fastened underneath the carriage and directly over the cam, the carriage rocking and feeding along the rod *G*, according to the revolution of the cam.

When set, the comb blank rests under the stop *H*, so it will be seen that as the carriage rocks and feeds, the blank is fed to the saw *I*, the blank being withdrawn and fed along one tooth at each revolution of the cam, only the extreme rise of which has a lead to the threads,

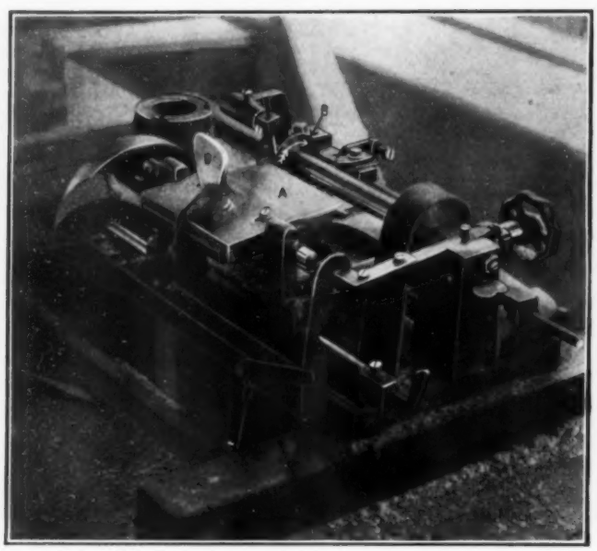


FIG. 10. AUTOMATIC FINE-TOOTH SAWING MACHINE

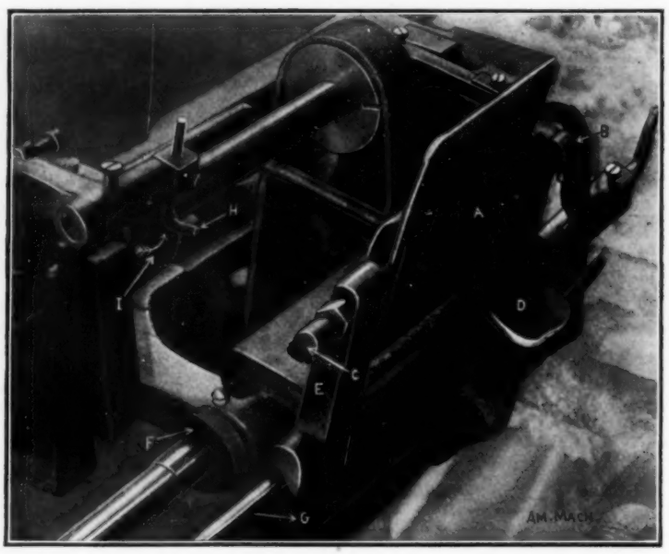


FIG. 11. THE CAM FEEDING AND INDEXING DEVICE

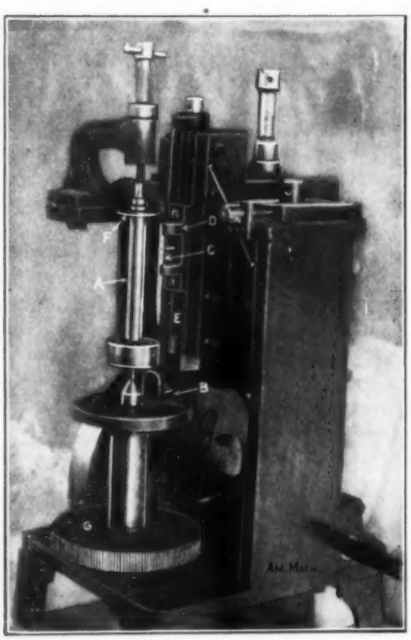


FIG. 12. AUTOMATIC SAW-FILING MACHINE

placed in the assembling press, as shown in Fig. 8, and the metal edges of the channeled back pressed firmly into the grooves milled in the comb. The press, when closed, looks as shown in Fig. 9.

This press works continuously about 20 stroker a minute, giving the operator ample time to remove and insert a comb while the jaws are open, plenty of finger room being allowed and the danger of catching the finger tips reduced to practically nothing.

SAWING FINE-TOOTH COMBS

The teeth on fine-tooth combs, having 30 teeth to the inch, are not cut as are the coarser kinds, but are sawed out in the automatic machine shown in Fig. 10, the comb blanks *A* being clamped in the hinged vise of the carriage, as shown, and automatically fed to the saw *B* by an ingenious cam movement, shown more clearly in Fig. 11.

In this cut the hinged vise *A*, which swings on the pins *B* and *C*, is shown thrown back. This vise is opened and closed by the thumb nut *D*, and is made to swing as it does in order to facilitate the rest being merely straight grooves, as otherwise the carriage would feed along while the saw was cutting.

FILING THE SAWS

The saws used are two inches in diameter and run about 4000 r.p.m. It is usually necessary to sharpen them every two hours. These saws must nec sarily run very true, owing to the fineness of the cut made, so the machine shown in Fig. 12 has been made to file these saws without removing them from the mandrel on which they run, the mandrel being taken bodily from its bearings in the automatic tooth-cutting machine and placed between centers in the filing machine, as shown at *A*, the mandrel being locked so as to turn with the indexing center, by a pin in the bracket *B*, which fits into a slit in the pulley. A three-cornered file *C* is clamped in the bracket *D* on the slide *E*, which works up and down, filing the teeth of the saw *F*, as they are fed around by means of the notched disk *G*, which is turned by a pawl worked by a crank motion.

Trimming the Saws

The filing of the saws naturally leaves a burr on the teeth, which would cause the saw to cut too wide a slit, so after filing, the mandrel is placed in the device shown in Fig. 13, with the saw between the ends of two hardened pieces of steel, and revolved by hand, the slot formed by the space between the ends of the steel pieces, of course, being set to trim

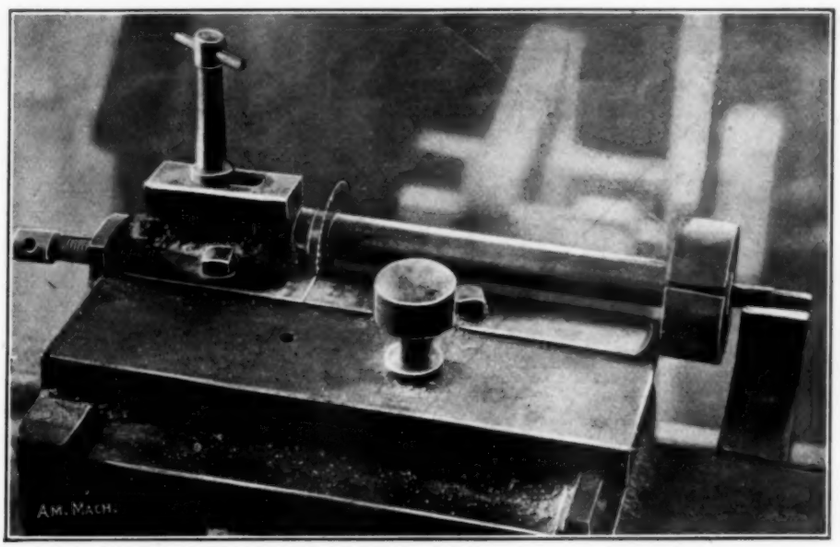


Fig. 13. Device for Removing Fins from Sides of Saw Teeth

the saw teeth to the correct thickness. After the saws are trimmed, the mandrel is ready to replace in the automatic machine.

Design Constants for Small Gasolene Engines*

By W. D. Ennis

a The horsepower developed at the engine shaft by one single-acting 4-cycle cylinder at 1000-ft. piston speed may be written

$$\frac{C d^2}{26{,}000}$$

where d is the cylinder diameter in inches and C = the ratio of the ideal work done per power stroke in ft.-lb. to the displacement of the piston per stroke in cu.ft.

The value of C is found to vary from 5970 to 11,008 for a 4-cycle cylinder, depending on the design and operation, the normal being 7830. These limits correspond to the range of mean effective pressures, 55 lb. to 90 lb.

b The horsepower developed at any piston speed S may be written

$$\frac{C d^2 f S^e}{24{,}200{,}000}$$

tentative values for the constants being, $f = 1.85$, $e = 0.9$, $S > 500$.

c The wheel-rim tractive force, in lb., necessary for speed on a level road only is

$$R_s = 0.0025\ A\ V^2$$

A being the transverse clearance area of the car, in sq.ft., and V its speed in miles per hour.

d That necesary for a speed V_g on a grade k is

$$R_g = 0.0025\ A\ V_g^2 + mk$$

m being the weight of the car in lb. and K the ratio of the rise to the distance traveled.

e The tractive force referred to the engine shaft for a wheel-rim tractive force R is

$$R + g$$

(where g is the difference between the actual tractive force at the wheel and the ideal computed tractive force; g being probably about constant for a given car.)

f The fundamental quotation of design is then

$$\frac{C d^2 f S^e}{24{,}200{,}000} = \frac{(R + g)\ V}{375{\cdot}5} \qquad [12]$$

which at 1000 ft. piston speed becomes

$$\frac{C d^2}{69{\cdot}1} = (R + g)\ V \qquad [13$$

g Equation [13] should be used to determine d at the condition of maximum power, and the corresponding necessary gear ratio is

$$u = \frac{336\ V}{N w}$$

where u = ratio of rotative speeds of car wheel and piston, and N = r.p.m. of car wheel having a diameter of w in.

h For any other condition, independent assumptions as to velocity and horsepower are impossible. The engine must have sufficient speed to develop the required horsepower. If the wheel speed is also fixed, the gear ratio is fixed and the limit of tractive force established. The gear ratio for a given car is a function of both the total resistance and the piston speed.

*Extract from a paper read before the American Society of Mechanical Engineers.

Die for Making a Pancake Turner

By M. Martin

Shown herewith is a die I designed for making an ordinary pancake-turner blade or shovel, in one operation, which included the rounding of the front and back, perforating and drawing the bottom.

The material used was 20-gage, cold-rolled strip steel, $3\frac{1}{16}$ in. wide, and an ordinary inclined press was used.

Fig. 1 shows two views of the finished blade, illustrating the rounded shape or outline at each end, the layout of the perforations, including the two rivet holes of the handle, and the shape of the draw, which, you will note, is $\frac{1}{8}$ in. deep toward the handle and gradually lessens toward the front.

Fig. 2 is a top view of the die, the arrow showing the direction in which stock feeds. *A* is the die bolster or shoe, made of cast iron, with a channel $\frac{1}{8}$ in. deep milled lengthwise milled in it, which is 0.005 in. wider than the stock for which it acts as a guide. The piercing and forming die are set in at *B* and *C*, the ends forming the parting die at *D*.

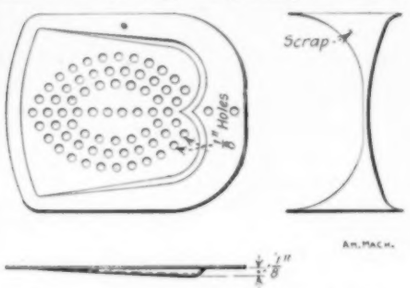


Fig. 1. Formed Shovel and Scrap

Rectangular slots are cut at *E E* to guide the parting punch. A spring stop-pin is placed at *F* to space the blank, but allows it to easily slide over after cutting off.

The depression in die *C* is not made shallower toward the outer end, as one would expect from the shape of the blade shown in Fig. 1, but is cut a uniform depth, making it convenient for grinding. The reason for this uniform depth instead of it being beveled to match the punch, is that the punch makes the depression in the blank, and the mere outline, as shown at *G*, is all that the die requires to hold the shape.

The stripper plate *H* is made from a plate of $\frac{5}{16}$-in. annealed tool steel and shouldered, so as to set into the milled channel of the shoe $\frac{3}{16}$ in., allowing exactly $\frac{1}{8}$ in. space between the face of the die and the bottom of the stripper plate, which is ample for the stock.

Fig. 3 is a view of the punches and holder. The holder has a channel milled its full length the width of the blank and $\frac{5}{8}$ in. deep, to hold the punch plates *A* and *B*, and another channel milled across it, to hold the parting punch *C*. The punch fits snugly in the channel, and

the base is notched, so that the punch plates *A* and *B* extend into it far enough to give a solid hold. This punch is also machined or formed to enter the guide holes shown in the die at *E*, which prevents the punch from shifting or cutting

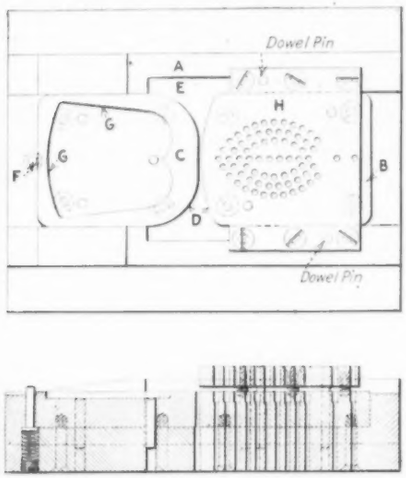


FIG. 2. PLAN AND SECTION OF DIE

the edges, making the combination practically a subpress, as the guides are ¼ in. longer than the perforating punches, so that the guide legs enter the die first, the parting punch itself being milled so that it is the same length as the perforating punches and the exact width of the stock, so that it assists in holding the stock centrally while cutting.

The drawing or forming punch has the shape of the depression, less the flare, and has the face beveled, so that from the back to the front there is a shortening of ⅛ in., and the corners are slightly rounded so as not to cut into the stock.

The hold-down *D* was hardened and ground perfectly flat on the face and back, and the shape of the forming punch cut out of it, so that the plate slides easily and yet fits closely around the cutting edge of the punch and the full surface of the blank is covered and held. The face of this plate is also machined to the exact width of the stock, so that it goes between the guides in the bolster and it is held in position by four shoulder screws, as shown, which allows sufficient movement. This plate is held down by six springs across it at *F* and also by the springs *G*, *H*, *I* and *J*, which give it sufficient pressure to prevent the stock wrinkling during the drawing process.

By executive order of President Taft, alumni of the National School of Engineering of Mexico, designated by the Mexican government, may be employed on the engineering work at Panama in order that they may have the privilege of observing the public work there in progress. As this order is in accordance with the principles of international courtesy civil-service regulations are waived.

Files and Filing

BY J. W. DICKINSON*

The saying is true that a workman is somewhat judged by the way he handles a file. To use a file properly is an art

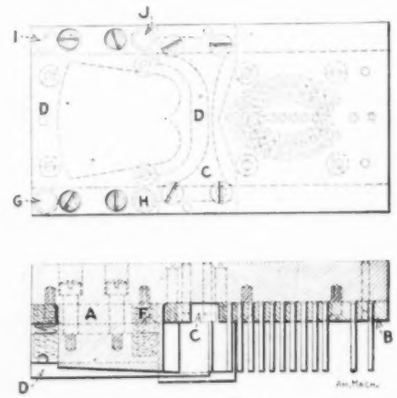


FIG. 3. PLAN AND SECTION OF PUNCH

with the machinist. The inability of many workmen to select and use a proper file for the work they are doing is a frequent and noticeable occurrence. Using a second-cut or pillar file for lathe work, as many do, displays a decided lack of practical judgment or a "don't-care" attitude.

The proper file for lathe work is a float file, or in other words a mill file, and this if reserved for the lathe and kept clean, will finish better the longer it is used. For lathe work the mill file will file smoother and without rings or scratches of any kind, especially when the file gets smooth or a little dull. It is also excellent for removing stock, next to the common bastard for vise work, but in no case where good work is required should the same mill file that is used for vise work be used for the lathe, or *vice versa*.

The pillar file is for all general bench work, particularly tool making, where little stock is to be removed, such as backing off mills, fitting keys, etc. Of course, it is not necessary to dwell on the use of the bastard file. Experience demonstrates that a narrow bastard is better to use in most cases, because when the same weight is applied to this file more stock can be removed in a given time and with greater ease than with the wider one. Three-cornered file, the crossing, the knife, the barrette and needle files are all in a class with the pillar, only the selection is a matter of size and shape, according to the character of the work.

When it is required to file straight on bench or vise work, the first thing to consider is the location of the high part of the file you are using, which of course, is done by looking across the file lengthwise. After this is found, lay the high point on the work with the first two fingers, or the base of the thumb, on the file directly over the work, and with the other hand grasp the file handle and proceed to file, but do not let the hand that is resting on the work leave the latter at either end of the stroke.

This is easily told but cannot be done without considerable experience, although it is the proper and easiest method. The hand to put on the file is not designated for the reason that it may be a case of a left-handed, as well as a right-handed one. Draw filing is best done with a mill file but it must be kept clean. A little chalk put on the work is a great help.

In all cases of vise filing (except when filing straight by the method explained above) take a stroke the full length of the file, a steady but not a fast movement.

This is where the straight filing method is used to advantage. File the part of the key that goes in the shaft to a medium driving fit in the shaft. The other half of the key is filed to about the same fit to the gear keyway. After this is done drive the key into the shaft. Now caliper the gear from the side of the hole to the top of the keyway with inside calipers and transfer to outside ones. After this file the top of the key off to the outside calipers. The key should be only a light driving fit at the top and bottom, to prevent springing the shaft or wedging the gear, thus leaving it free to run out after being forced on the shaft.

After selecting the proper files, rough the die out as near the line as possible, using a long stroke of the file. To bring the pattern to the top of the die, insert it in the die and mark the bearing spots with a lead pencil. Now take out the pattern and file where marked; repeat this until the pattern is brought to about $^1/_{32}$ of the top of the die. Another method is to use blue lead on the edges of the pattern instead of marking with a pencil.

A good file card will keep a file clean. It helps to rap the file before using the card, but do not rap the file on any part of the lathe, especially the ways. A tool may be put in the tool post to use for rapping the file on.

Filing hardened stock tempered to a dark straw, or lower, in color. This is sometimes required in tool making, especially in blanking dies after being hardened. Here it is required to bring the pattern back to the top of the die because of the die shrinking in hardening. The best file to use for this sort of work is a rather coarse one, No. 0 or No. 1. Use a great deal of pressure and a very slow stroke. Several files may be worn out before the pattern is black in place but thsi is better than stoning out the die if it is drawn to the point where it can be filed.

*Foreman, Russell & Erwin Co., New Britain, Conn.

Where Old Machines Do Good Work

Special Correspondence

One of the cases where "know how" counts for more than new machines. Repair work where an old machine and experience make a good showing.

Do machine tools ever wear out beyond the useful point for the repair shop?

An interesting shop in New Orleans is Connell's Iron Works, a comparatively small place which is just recovering from the effects of a fire. This shop has some interesting old tools and does some fairly heavy repairs besides building a special stoker.

Mr. Connell served his time in the old Fletcher & Harrison shop and was later chief engineer on several liners, so that marine repairs are second nature with him. A rather strange coincidence in this connection is, that recently in New Orleans he came across the old lathe on which he worked while an apprentice in New York. How it got there no one seemed to know, but if it could record its wanderings, they would probably be extremely interesting.

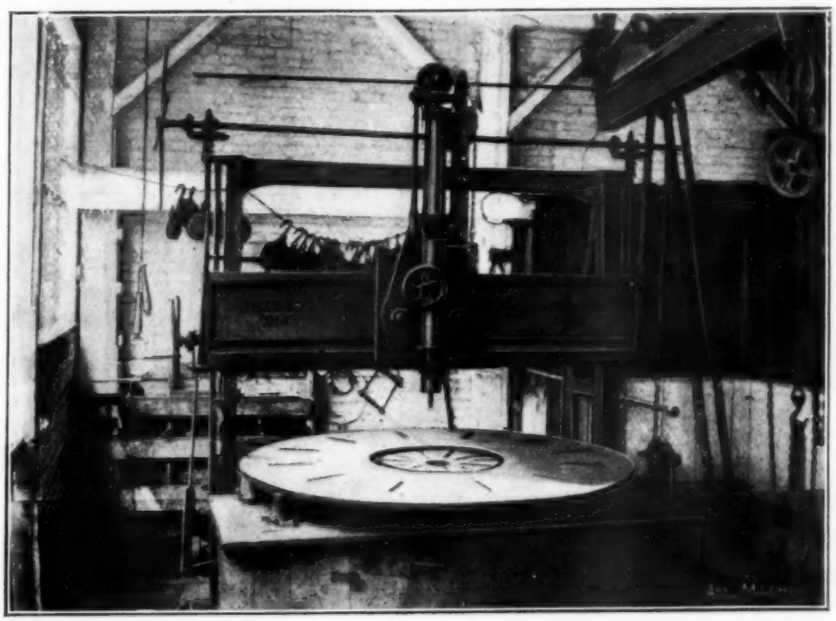


FIG. 1. AN OLD NILES BORING MILL

An old Niles & Co. vertical boring mill, shown in Fig. 1 is still in use. The table has been enlarged by the addition of the thin plate or table, which is supported under the cut by rollers. These can be seen at the left. They are adjusted by wedges and can be set very accurately so as to take the downward thrust. The thin table makes them extremely useful.

The exact date of this boring mill was unknown to Mr. Connell but the name "Niles & Co. Cin." on the cross rail, places it in the neighborhood of 1870. The general lightness of the design, of both the housings and the arch or yoke between them, indicate the date in a general way.

Fig. 2 shows an interesting old slotter of the days when the Corinthian column was the proper thing in machine-tool architecture. This, in connection with the cross of St. Andrew under the table, makes rather a striking combination.

It is interesting to note the way in which the designer extended the capitals of his column to form a guide for the ram as well as the lower guide arm and the crankshaft bearing. The bearings, though small, are well apart and the machine is still doing whatever comes along in the line of slotting. It will also be noted that the work table has a rotary motion in addition to sliding in both directions.

WORK FOR THE OLD-TIME MACHINIST

Just to show that there is still work for the old-time machinist—work where the hammer and cold chisel still play a part in fitting—Fig. 3 is presented. This illustrates three segments of a gear for turning a draw bridge. The sections are approximately four feet long, the teeth about three-inch circular pitch and the diameter of the completed gear about 30 feet.

A 30-foot circle is drawn on the erecting shop floor, as can be seen by the portion of the chalk line shown, and the pads on the ends of the sections are fitted until they come together and bring the section to the proper position on the curved line.

When much material is to be removed, the section is clamped to the carriage of a big lathe at the right angle, and moved up against an improvised sweep milling cutter which is fastened to the face plate. The cross feed of the lathe carriage moves the work past the cutter and the joint is easily faced up. In many cases, however, there is only a little metal to come off and the hammer, cold chisel and file provide the most convenient means of doing it.

The sections are then bolted together as shown and the holes in the center rib are used to fasten the segments to the bridge which is to be turned by it. A third section is shown on the floor beyond the other two.

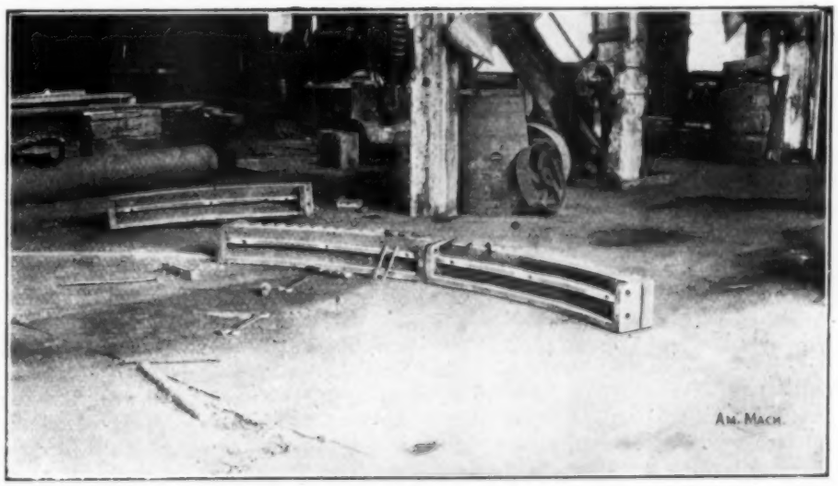


FIG. 2. LAYING OUT AND FITTING A LARGE GEAR

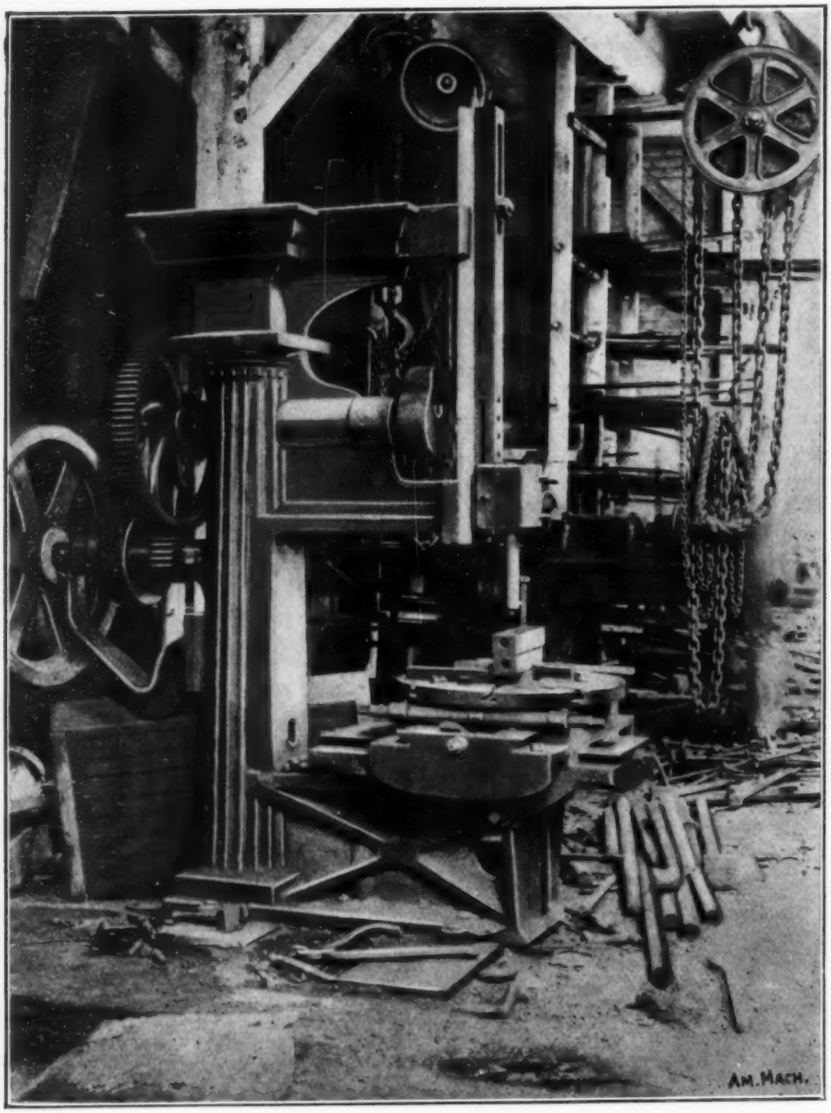


FIG. 2. A SLOTTER OF THE CORINTHIAN PERIOD

Limits for V-Thread Gages

BY P. A. FREDERICKS

Necessity recently arose in a certain shop to design gages for a number of special pitch thread sizes of V form, and some of the information obtained from various sources should prove of general interest.

The sizes referred to had previously been determined mainly by the taps, and as these were ordered simply as ¼-40, ⅜-28, etc., and from various makers, the results were anything but uniform.

As it was obviously not desirable to go to unnecessary expense through setting limits closer than the manufacturer could reasonably be expected to work, an attempt was made to determine, by gaging taps in stock, something of the limits used by tap manufacturers. Several taps of the same marked size were measured both on the outside and on the pitch diameter, but the results were not such as to warrant depending on them for setting limits, as considerable variation was found, especially in taps, from different makers. Such being the case, arbitrary limits were decided on.

On carefully going over the list of A. S. M. E. thread sizes (the only one, by the way, that has a definite standard provided for minimum and maximum screws and taps), it was found that the maximum screw was considered as the nominal thread size, the various other sizes being figured therefrom, and that the limits listed seemed well adapted to the work in hand. A list was, therefore, prepared from the A. S. M. E. tables, giving: 1, amount over nominal thread (maximum screw) size for pitch diameter and outside diameter for maximum tap size; 2, amount over nominal thread size for pitch diameter and outside diameter for minimum tap size; 3, amount under nominal thread size for pitch diameter and outside diameter of minimum screw size. The maximum screw, being the base size, was not listed.

This list was compiled for each pitch, as it varies according to pitch, and not diameter. Having now determined on allowances it would seem that all was plain sailing, but on measuring, by the three-wire system, several standard taps to see how the limits compared with the table prepared, it was discovered that in all cases the pitch diameter, as obtained by the formula for measuring with three wires on V-threads:

Pitch diameter = sizes of wires — 3 times wire size + 0.886 pitch, was considered more than the oversize on the tops of the threads would warrant.

To be explicit, a ¼-20 V-tap, which should, according to the formula given in almost every catalog listing taps,

Double depth = 1.732 pitch have measured 0.2081 on pitch diameter, allowing 0.002 for the oversize, actually measured 0.2116.

It was evident that something had been allowed to provide for the practical impossibility of cutting a theoretically sharp V-thread, but the question was: How much was this allowance, and was it an accepted standard among tap makers applied to the manufacture of all V-taps?

Measuring taps in stock was not a satisfactory method of determining this, for, as stated before, some of these varied excessively, and there was no means of determining where the tap had been figured to come, because of error in manufacture.

An inquiry addressed to one of the men "higher up" in the mechanical world, invoked the somewhat obscure and certainly in this case erroneous reply that,

> If we found the pitch diameters and outside diameters had different relation as regards oversize limits, it would indicate that the form of thread was not correct.

However, persistent inquiry in various directions brought forth the fact that tap manufacturers universally figured pitch diameter from the formula:

Double depth = 1.616 *pitch.*

A comparison of this formula with standard taps in stock, showed close accordance in nearly all cases. Having thus obtained the basic or nominal sizes and having determined upon the limits desirable, the set of gages was finally designed, and consisted of soft-steel plates with hardened threaded buttons inserted, the buttons being adjustable to provide for resetting to compensate for wear, etc., by means of setscrews similar to an ordinary die-wrench for button dies. Two buttons were provided, one "go" and one "not go" for each plate. The screws were adjusted in the toolroom and then ground flush with the plate to prevent, and to show up, any tampering with gage sizes.

For tap holes it was considered sufficient to measure the taps, using for this purpose an ordinary micrometer for the outside diameter, and a Wells Bros. thread micrometer for the pitch diameter.

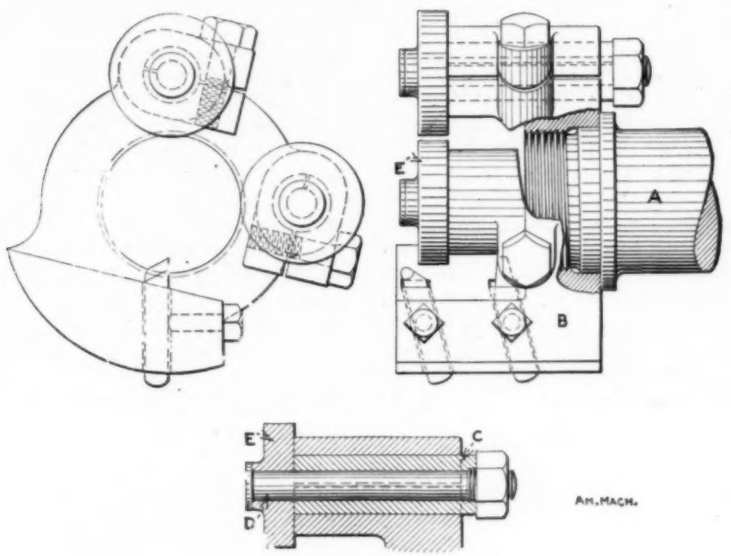
Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Roller Rest Turning Tool

It occurred to me that your readers might be interested in a tool that has been of great service to me, and one that is not difficult to understand or make. It is a tool that is not expensive when its utility and adaptability are considered.

A is the shank for adapting the tool to the screw machine and this can be made to suit any machine. I make the body of openhearth bar steel, making square holes to receive standard tool bits and being careful to have the tool about one-sixteenth of an inch above the center. The holes that are to receive eccentric bushing *C* are drilled at 90 deg. and 180 deg. from the top of the tool. The eccentric bushing has a head on one end, and this is milled hexagonal to the same size as some of the screws on the machine the tool is to be used on. This eccentric bushing should fit easily in the body *B*, and should be about ¼ in. longer than the body, so that the roller *E* can be adjusted endwise to suit the cutting tool.



A Roller Rest Turning Tool

The stud *D* is made of a good grade of steel, carbonized and hardened, so that the roller *E* will not wear or cut into it. The roller *E* has a boss on one side to give a good bearing on stud *D* as soon as the edge of the roller comes in contact with the work. The rollers are also hardened, and if made very hard practically no trouble will be experienced with the bearing on the stud.

It will be seen by referring to the end view that there is a slot cut into each hole from one side; this permits the binder screw to clamp the eccentric bushing *C*, which is also split on the thick side, making it possible to clamp the stud *D* at the same time. This will also take care of the end thrust of roller *E*.

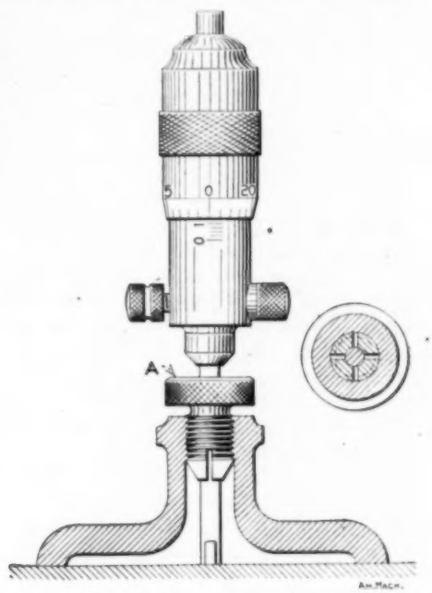
This tool is not difficult to adjust to the work. The first thing is to set the cutting tool and turn the work to the diameter desired, and then with a wrench on the clamp screw and another on the head of the eccentric bushing, loosen the clamp screw and turn the bushing until the roller *E* comes in contact with the work. Then clamp in place and the tool is ready for business, and you can be sure the back rest will not move. The tool can be made to take smaller work by using larger or smaller rollers.

I am using tools like this, made of one piece, for smaller work, with great success, some of these having three and four cutting tools and only one pair of rollers. Long work is turned by making the shank hollow. Notice how small this adjustable tool is. It will turn up to three inches diameter, and is only 6½ in. across.

Defiance, Ohio. S. Thompson.

Inside Micrometer as Height Gage

The accompanying cut shows an attachment or base, by the use of which an ordinary inside micrometer may be converted into a height gage.



Inside Micrometer as Height Gage

The base may be made of cast iron, machine steel or any suitable metal, and is easily turned up in the lathe. The split nut *A*, used to lock the rod of the micrometer, may be made of brass, machine or tool steel, as desired, and with a little care in making, an extremely useful tool is the result.

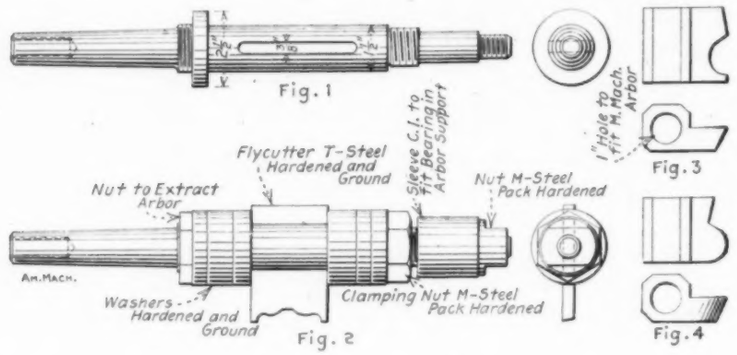
Buffalo, N. Y. A. W. Massecar.

Fly Cutters in the Toolroom

When a tool maker, I found very few shops equipped with anything to handle fly-cutter work cheaply and consequently concluded that that branch of tool making was very much neglected. The fly cutter can be used in many cases and will save a lot of time in making up punches and dies which in the ordinary way are roughed out in the shaper or miller and then finished by hand.

I have seen tool makers, on a difficult piece of work, make up a forming tool for the shaper and after a lot of testing and indicating to get the tool set right, trust to good luck to get the shaped part in correct relation to the base of the work. The shaper tool is very unsatis-

factory, as even with a spring tool-holder it is likely to chatter and leave ridges on the work. Its use is also limited, as it would be impossible to use a forming tool with a cutting edge of 3-inch width, in an ordinary toolroom shaper.



FLY-CUTTER ARBOR

The same thing applies to the fly-cutter arbors as usually made by manufacturers of milling machines, as the hole in the arbor for taking fly cutters is generally about ¾ inch square and the cutting face, if made 3 inches wide, has a tendency to twist over and drag, if the cut is a little heavier on one end.

The accompanying diagrams show a fly-cutter arbor which is not very expensive and which overcomes the above mentioned difficulties. Fig. 1 shows the arbor, which is made 1½ in. in diameter so as to be strong enough for a heavy cut. The slot is made ⅜ in. wide and of sufficient length to take any fly cutter. The fly cutters are made from ⅜-in. flat stock, and in case of any warping in hardening the sides are easily ground to suit the formed end.

Some readers will perhaps take exception to the fact that the cutting face is not radial. The consequent error is very slight, as on a cutter with its farthest point 3 in. from the center and making a form ½ in. deep it would be only 0.001 in., which can if necessary be allowed for in the making of the cutter.

In conclusion I want to show two cutters, Figs. 3 and 4, which I had to make to give the right shape to a forming punch and die in a shop not equipped with the above arbor. From the sketches it can readily be seen that a few such cutters soon outweigh the cost of making an arbor.

Chicago, Ill. H. B. CARLSON.

Accurate Setting of Graduated Circular Scales

It is common knowledge with every good mechanic that it is impossible to set a universal-miller table perfectly parallel with the travel so that an end mill will cut just as deep at the tail center as it does at the dividing head. This is due to the physical inability of accurately bringing two sheared lines into continuity. No work, therefore, can be set up and done correctly which involves angular surfaces obtained by such devices as the lathe compound rest, dividing head, planer head, etc.

In order to overcome this difficulty, both in the toolroom and for production work where it takes time to juggle a tool to a correct angle with gages, or by fitting, we have equipped all of our old tools, and new ones when delivered, with what we call centering pins. These pins are common taper plugs, such as are used to centrally locate the cross-slide of an engine lathe when using a carriage turret. All 0, 30-, 45-, 60- and 90-deg. positions are for once accurately located and the fixture drilled and reamed for the taper plug in position.

Some of the more common angles, which frequently repeat themselves, are also located on special tools.

It will be readily seen that only one exposed hole is produced, and this one is normally protected from dirt with a half-length plug, if the setting is an odd one.

It is rather surprising that the machine-tool builders do not use these plugs, as their application costs very little when measured by their convenience and the tendency to raise the efficiency of the shop.

C. S. COLE.

Electrical Engineering Storage Battery Co.

Sandy Hook, Conn.

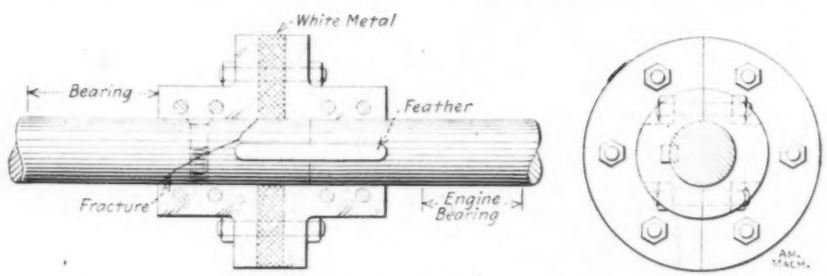
Repairing a Dynamo Shaft at Sea

It was one of those old freighters that jog across the Pacific Ocean at a maximum speed of eight knots when the weather permits, and which, when in heavy weather, are usually so shaken up that every little weakness in construction develops. This old packet had been renovated and modernized by the addition of a dynamo and fitted throughout with electric lights.

Owing to lack of floor space, a specially designed platform was built out from the ship's side to carry the electric-lighting plant. In rough weather this vibrated to such an extent that nothing short of a miracle prevented it from going to pieces. To further complicate matters, the engine bedplate was a separate casting from that which carried the dynamo, the only rigid connection between the engine and dynamo being the shaft carrying the armature, this being a direct-driven machine.

The shaft was in two lengths, secured by a clamp-flange coupling, as shown in the diagram. This arrangement caused an unusual bending stress to be set up in the shaft when the vessel was pitching, with the result that the shaft fractured just outside the armature bearing. Fortunately, it was a scarf or angular break, and therefore adapted to the method of repair which was applied.

A ⅞-in. hole was drilled through the shaft at right angles to the break. One-half was left a clearance hole and the other half tapped, the broken ends were



A DYNAMO SHAFT REPAIR AT SEA

then carefully placed together and a bolt screwed through into the tapped hole, the head of the bolt was cut off ⅛ in. from the shaft, riveted over and filed flush with the shaft. One-half of the flange coupling was then clamped over the break to hold it solid. This caused a space of three inches to be left between the faces of the flanges, so the coupling was moved along the shaft about 1¼ in., which was all that could be spared.

This arrangement left the old coupling bolts too short, and as there were no bolts of that diameter long enough, four pieces of threaded stud iron were cut off of a length to pass through both flanges and take a nut on each side. Strips of wood

were tied round the flanges parallel to the axis of the shaft, to form a mold, into which babbitt metal was poured to fill up the space. When the metal had solidified, the nuts were tightened up hard and the whole job made solid.

The engine was turned by hand to prove the armature true between the polepieces. Steam was turned on very slowly to steady the engine and give the job a working test, which it withstood. The speed was then gradually increased until normal was reached, and current once more passing through the circuit.

The diagram shows this job, which lasted 10 days before a home port was reached and a new shaft procured. The old one was taken out, welded and trued up in a lathe, so that now there is a spare one aboard for such an emergency.

Dundee, N. B. C. F. MEYERS.

Pumping Diagrams

When dealing with pumping questions if often entails a fair amount of "figuring" to obtain say the power required to pump a certain quantity of water to a given height, when the efficiency of the pump is known, or having a certain amount of power available how much water can be raised to a certain height per hour? To arrive at any of the above answers a considerable amount of time is involved, whereas with the following diagrams any of the above requirements can be seen at a glance.

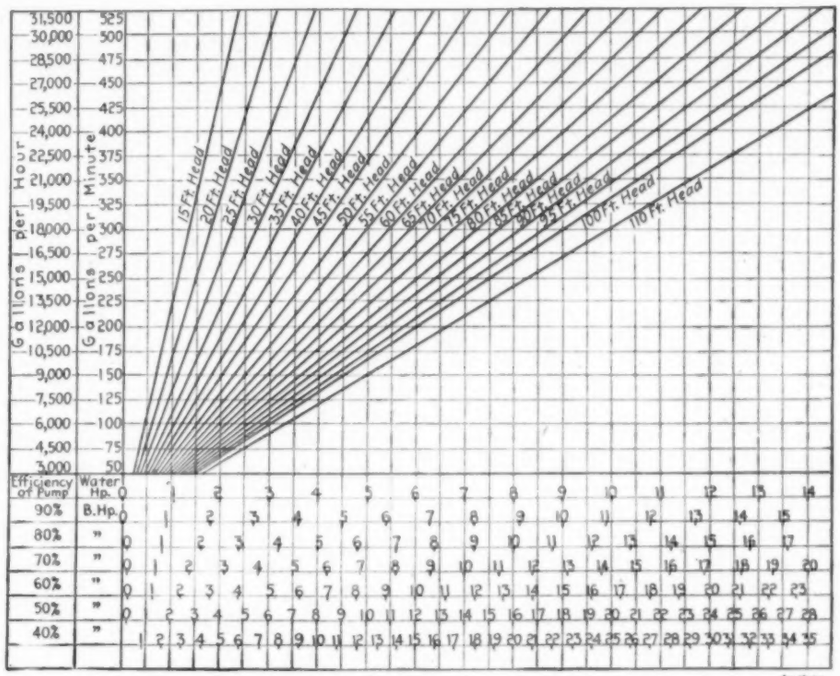
The accompanying diagrams give the brake horsepower, number of gallons per minute, and per hour, the various heads in feet, and the pump efficiencies from 15 ft. up to 300 ft. head.

As an example, we require to pump 0.350 gal. per minute with a total head of 85 ft. and the efficiency of the pump is 60 per cent. What is the brake horsepower required?

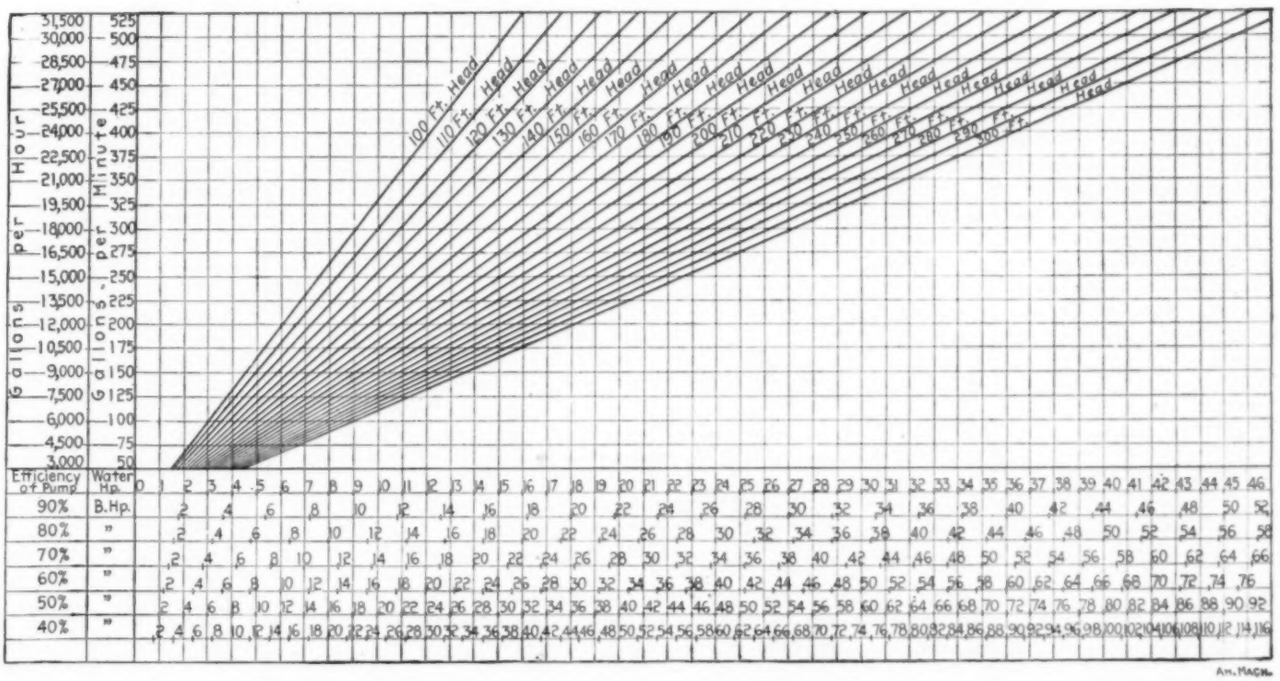
On the left-hand side of the diagram is shown gallons per hour and gallons per minute. On the line 350 gal. trace along toward the right hand until the horizontal line intersects the diagonal line marked "85 feet head." Then trace the vertical line at this intersection downward and at the bottom of diagram will be read the b.hp. = 15, on the horizontal line of 60 per cent. pump efficiency where the vertical line intersects.

W. E. WORT.

Letchworth, England.



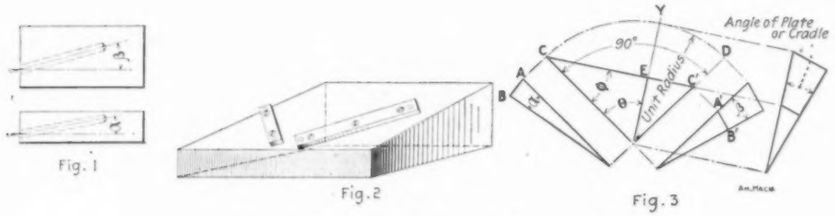
PUMPING DIAGRAM 15 TO 110 FT. HEAD



PUMPING DIAGRAM 100 TO 300 FT. HEAD

Designing Jigs for Drilling Angle Holes

It has been the usual custom in designing jigs for angle holes, where provision cannot be made for angle feet on the jig, to place the jig on an angle plate or cradle, which is easy enough for holes with a single angle, but when considering a double-angled hole, like Fig. 1, the jig must be placed in a different position on the cradle, making it more difficult to determine the angle of the plate and the position of the jig on it, and in consequence of this I have derived formulas whereby the determination of the angle of the plate and the position of the jig on it are simplified.



DESIGNING JIGS FOR DRILLING ANGLE HOLES

Fig. 2 represents the cradle, showing the location of the strips used to give position to the jig.

Referring to Fig. 3, which is laid out in the same plane as the surface of the cradle, an angle of 90 deg. was first constructed, representing the stop strips on the plate, and then after the unit radius was scribed, angles α and β were laid off one on each side of the 90-deg. angle, representing the angles of the hole. The sine $A\,B$, of the smaller angle α, was laid off in the larger angle β, as shown, by $A'\,B'$. The point where $A'\,B'$ intersects the hypothenuse of the angle β was projected to the 90-deg. angle, thus locating a point C' that lies in the same plane as the origin O and the points C and D, which is the surface of the angle plate. Connect C and C by a straight line. Now any point along this line is the same distance from the base of the angle plate. Next draw a line through the origin O, perpendicular to $C\,C'$; then this line will represent the greatest slope of the plane $C\,O\,D$, which is the required angle of the plate.

The first step in deriving the formulas was to find the length of line $C\,O$, which is equal to $A'\,B'$, or the sine of α multiplied by the cosecant of β.

$$Sin\ \alpha\ cosec\ \beta = C'\,O = tan\ \phi$$

Hence the angle ϕ can be found and the next step is to find the length of the line $E\,O$. This is the sine of ϕ and also the hypothenuse of the angle of the cradle.

The altitude is the sine of α, as any point on the line $C\,C'$ is the same distance from the base of the cradle; hence the angle of the cradle is equal to $\frac{sine\ \alpha}{sine\ \phi}$. Therefore, no matter what the angles of the hole to be drilled are, the angle of the cradle can be found by first taking the sine of the smaller angle and multiplying this by the cosecant of the larger angle, which equals the tangent of some angle, as ϕ. Now divide the sine of the smaller angle by the sine of ϕ, which equals the sine of the cradle angle.

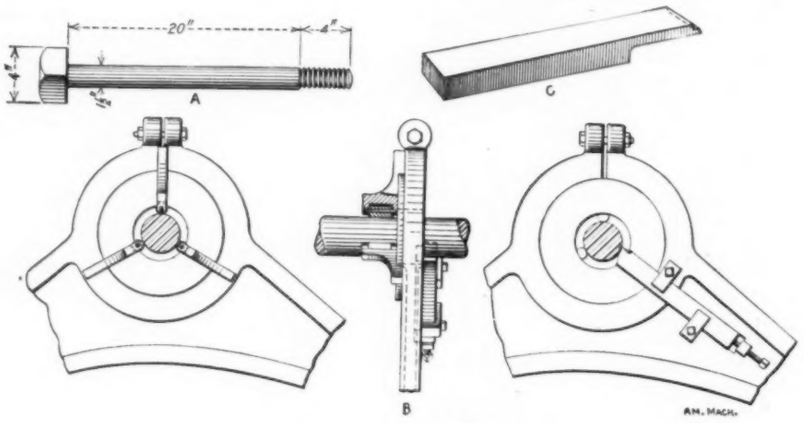
To find the angle θ, from the center line $Y\,O$, at which to set the strip $C\,O$, lying on the same side as the smaller angle, subtract ϕ from 90 deg., and the other strip is 90 deg. from this.

S. CLIFFORD.

Philadelphia, Penn.

Making Large Bolts

Most uptodate factories use Jones & Lamson, Gisholt or similar machines with special attachments for bar work, but in unusual cases, or when no attachments are on hand, other means must be used.



MAKING LARGE BOLTS

I had to make several hundred bolts, such as shown at *A*, out of 50-point carbon steel, so I took an old steadyrest from a Gisholt lathe, annealed the jaws and fitted hardened-steel rollers to each jaw, as shown at *B*. I also milled a slot about 3/8 in. deep and 1¼ in. wide in the steadyrest to hold a tool as shown. I next turned my pieces, previously cut to length, down to 1 11/32 in. diameter for about 2½ in. on one end, chucked them a second time in soft jaws, put my chuck in the steadyrest with the three rollers at the back and took the 2 11/32 in. of stock off with one roughing cut.

While my cut was going on, I centered the outer end with a combination center drill in the turret, and when I had all the pieces roughed out, I put a center in the turret, took a finishing cut and chased the thread with an average of 27 min. per piece.

For cutting off steel castings or forgings on a Gisholt, I recommend a cutting-off tool, ground as shown at *C*. On steel work a good many tools break if they have to cut deep, and the man on the machine never stops to consider the reason, but the deeper the cut goes the duller the tool gets and the hotter the chips, so that as the chip leaves the tool edge it is wider than the slot the tool cuts on account of its expansion, and as more chips are coming on the surface of the tool, the pressure against it increases until finally the tool breaks.

Elyria, Ohio. FRANK J. ANDERLA.

Pack-hardened High Speed Steel

Recently I was in a shop where they make formed cutters for wood-working machinery. The great drawback to the use of high-speed steel for this purpose has been the loss of form due to the high heat during treatment.

In the shop referred to the cutters after annealing are milled to shape. They are then packed in granulated charcoal in cast-iron boxes and subjected to a heat of 1600 deg. F. for half an hour.

The box is then dumped on a screen to get rid of the charcoal and the cutters are cooled off in oil. This treatment produces a cutter which for wood gives first-class results. There is no scale and the cutter is practically as it was milled. It is possible that metal-milling cutters could be made in the same way. The steel used was Rex A. A.

New York, N. Y. E. A. DIXIE.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

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Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.
Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1911, 1,358,200 copies. For January, 1912 (American weekly, American monthly, English weekly and German weekly), total, 92,750.

Of this issue, 27,250.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 233

Indexing with Our Outline of Topics

Those who use a card index for keeping track of articles appearing in the AMERICAN MACHINIST will find that their work is made easier by the new form used in the "Outline of Topics," which appears each week in the back of the paper. The addition of the date of issue and the name of the paper shows all the information needed on an index card.

This addition eliminates the necessity of writing on the index card, so that those who contemplate using this form of index will find it very easy to make a beginning. There can be no question as to the value of being able to find any desired information, and to find it when it is wanted. The more easily this can be done the more readers will likely avail themselves of this method.

Recognizing a Principle

The article on Mr. Bullard's new turret construction, which appears elsewhere in this issue, is an example of a principle in machine design that occasionally makes its appearance without being recognized, and inasmuch as the application of the principle is almost invariably an improvement, it seems worth while to call attention to it.

American Machinist

This principle may be called, for want of a better term, the division of functions. One of its early examples, which has now been almost universally adopted, is the well known Pratt & Whitney type of turret latch bolt, in which the registering side is radial, while the indexing side is inclined. The earlier type of latch bolt was a truncated V, in which both sides were equally concerned in the indexing and registering. Making one side of the bolt radial with the turret was simply a case of this division of the functions by which one edge was made to do the registering, while the other did the indexing, and Mr. Bullard's construction carries the same principle a step further by dividing the two functions between two pieces instead of between two sides of the same piece.

Another illustration of the same principle is found in the use of one V and one flat for grinding surfaces in grinding machines, and another illustration of it is found in the narrow guide as now applied to a good many English lathes, in which the horizontal and vertical grinding functions are divided.

For other illustrations we may mention the latest construction of the Newall measuring machine and the Taylor system of screw gages, both of which have been illustrated in our columns.

In the Newall measuring machine, the functions of carrying the weight of the parts and the doing of the measuring are divided between bearings and the screw, instead of both being performed by the screw, as usual, while in Mr. Taylor's screw gage each element of a screw has its independent test instead of all tests being combined in a single gage.

Are not these examples enough to lead to a recognition of the principle and to a deliberate instead of, as heretofore, a haphazard application of it?

The Effect of Improper Awards

It is no easy matter to decide on the merits of either men or mechanical devices, and there are few more thankless tasks than the awarding of medals. We realize fully that it is much easier to criticize awards than to make them fairly, but it is extremely difficult to understand the action of the American Museum of Safety in awarding its medal to Dr. Alvah H. Doty at its recent annual exercises.

The awards to the Norton Company and to the Pennsylvania Railroad can hardly be questioned by anyone, as they are undoubtedly the result of studying the achievements of the year along this line. But the value of these seems to be cheapened by the third award "for progress and achievement in hygeine and sanitation and the mitigation of occupational diseases" to the former Health Officer of the Port of New York. This is particularly noticeable when we learn that the medal only mentions occupational diseases.

Without questioning the ability or faithfulness of Dr. Doty in the least, it is difficult to see how his work made for progress in hygiene, sanitation, or least of all, the mitigation of occupational diseases. If he had promoted the sanitation of a great city instead of merely keeping out diseased immigrants, there might be more reason for the award.

It would certainly seem as though such an award should be made in cases like the Diamond Match Co., which relinquished patent rights to aid in eliminating the prevalence of the deadly "Phossy jaw" or that of A. J. Williams, assistant foreman in the electrotype department of the Government Printing Office.

Mr. Williams' invention was more in the line of work for which the prize was conceived. In the art of electroplating graphite dust, commonly used, has resulted in a pernicious prevalence of pulmonary diseases. It eliminates this objectionable feature by the use of a liquid which takes the place of the injurious dry-graphite process and answers all purposes equally as well. This invention was of such value that the Government, through an unusual procedure, paid Mr. Williams a mark of recognition.

We believe the American Museum of Safety is in position to render valuable service to the community, and we regret to see such an action, as it is to be feared that awards of this kind will not increase the interest or confidence in that institution, and without these, which also means coöperation, it can hardly hope for the support or the success it deserves.

Fire Risks in Machine Shops

When we look around the average machine shop many of us fail to realize the extent to which the fire hazard exists. This is probably due to the fact that the most prominent objects are the machines and materials which are non-inflammable, and also because we are so accustomed to them that we do not view them in the same light as the outsider, particularly those who have made a more

or less exhaustive study of the question of fire protection.

When we do stop to consider the matter, however, we see far more than the machinery and metal and find that even in shops which are very careful to provide metal receptacles for oily waste there is still much to burn and that the burning can cause more damage than at first seems possible.

With very few exceptions we find oil-soaked floors and ceilings, except in the case of concrete shops, which are in the minority. These two factors alone create a distinctive fire hazard and even if the fire does not originate in the shop itself, add tremendously to the chances of destruction, should a fire creep in from the outside.

When we consider that even strictly fireproof buildings have their entire contents destroyed, if of an inflammable nature, if the fire can get in from the outside, it becomes all the more necessary to guard against this in the case of the ordinary shop.

This is clearly recognized by the insurance companies, as can be seen from their substantial reduction of insurance rates in cases where automatic sprinklers and other approved devices are installed in machine shops and in similar buildings. The National Board of Underwriters has a standard which all sprinklers recommended by them must pass and this has proved so reliable that the constituent companies include in their policies all damage due to accidental discharge without adding to the premium of the policy.

Considering the fact that the most disastrous results of fire, aside from possible loss of life, come from the disorganization of business and the delay in filling orders, it seems very plain that it is good business to provide in every way for fire prevention rather than to depend on remuneration by the insurance company for fire loss. And when we find such substantial reductions in insurance premiums as will pay for an efficient installation in a very few years, there is all the more reason why the matter should be carefully looked into by all shop managers.

Customs Definition of "Machine Tool"

The latest decision as to what constitutes a machine tool is of interest not only to manufacturers but to those who have endeavored to formulate a definition which would satisfy all conditions.

In sustaining a protest filed by the Georgia Pulp and Paper Co., the Board of United States General Appraisers decides that the term "machine tool" as used in the Tariff act of 1909 is not restricted to machines used exclusively in the working of metals. The board holds that the provision may be applied as well to wood-working appliances. The machines in controversy are barking or rossing machines used in cutting or stripping the bark from pulp wood. Duty was assessed at the rate of 45 per cent. *ad valorem* under the provision for "manufactures of metal," whereas the importers alleged a tax of 30 per cent. as being "machine tools."

It appears that the wood-working machines are power-driven appliances for working on wood with cutting tools. The Government claimed before the board that it established by the record that the term "machine tool" is used in trade to refer only to such machines as are used in the working of metal. Judge Fischer disagrees with this view, and finds that there is no such definite, uniform, and general understanding of the term as would bring it within the commercial designation sought by the Government. He says: "Altogether it is a question that affords more than doubt that if you turn iron in a lathe it is a machine tool, but if you turn wood it must belong to another class. The question may be better stated when we say that it does not appeal to us that if a lathe for metal working is purchased, a machine tool is bought and sold, while if you buy a wood-working lathe, then the particular name of the machine (lathe) is what the trade understands as the object of purchase and sale. A machine tool is a term which in common use would without question embrace a power-cutting machine used in wood working. We hold the merchandise to be machine tools."

Personals

Thomas W. Wilson, for some time connected with the Fiat Co., has been appointed works manager of the Oakland Motor Car Co., Pontiac, Mich.

Wm. J. Crane, for more than twenty-five years with the Joseph Dixon Crucible Company, has become vice-president and sales manager of the Ajax Metal Co., Philadelphia, Penn.

Frank A. Haughton, formerly general superintendent of the Taylor Iron & Steel Co., High Bridge, N. J., has become works manager of the Remington Arms & Ammunition Co., Ilion, N. Y.

Walter Knapp has left the employ of the Niles-Bement-Pond engineering department, at Plainfield, N. J., to accept a position as assistant superintendent of shops, League Island Navy Yard, Philadelphia, Penn.

S. George Freund, who has recently returned from a European trip, during which he opened an office in Berlin, has established an office as consulting engineer for foreign trade at 100 Broadway, New York City.

Robert G. Clark, for a number of years in the employ of the E. W. Bliss Co., of Brooklyn, N. Y., is now in charge of the engineering department of the Emaus Foundry & Machine Co., Emaus, Penn., with headquarters in New York City.

G. L. Sprague, superintendent and supervisor of apprentices at the Allis-Chalmers works, has been appointed special investigator and field superintendent of the recently appointed Wisconsin state board of public affairs and civil service commission.

C. E. Clewell, for some time in immediate charge of shop and office lighting of the East Pittsburg works of the Westinghouse Electric & Manufacturing Co., and a frequent contributor to our columns, has recently taken up work in connection with the illumination division of the detail and supply sales department.

Joseph A. McDonald, who for the last eight years has been superintendent of the Ohio works of the Carnegie Steel company, at Youngstown, Ohio, has tendered his resignation. James H. Grose Jr., for some years superintendent of the Howard Axle and Schoen Steel Wheel Works of the same company, has been appointed to succeed Mr. McDonald.

Obituary

John Seaton, president and treasurer of the Locomotive Finished Material Co., Atchison, Kan., and a well-known figure in railroad manufacturing circles, died on Jan. 12 after a brief illness.

H. Frisbie, formerly a machinery manufacturer of Cincinnati, died on his farm near Chester, Ohio. Mr. Frisbie was known in the steamboat world as the inventor of the Frisbie valve used on steamboats.

William Donaldson, for the past six years superintendent and secretary of the Champion Tool Works Co., Cincinnati, Ohio, died Jan. 15, at his home in Ludlow, Ky. He was born in Cincinnati Jan. 31, 1842, and commenced his trade as a machinist at the age of 12, which business he followed during the remainder of his life, except for a period during the Civil War when he served as a quarter gunner on the gunboat "Chillicothe" plying on the Mississippi River. In the early 70's he was for a number of years in business in Cincinnati as a manufacturer of screw-cutting engine lathes. After disposing of his lathe business he acted as superintendent and designer of machine tools for a number of shops in Cincinnati, being at different times connected with Lodge & Davis, American Tool Works Co., Fosdick Machine Tool Co., Bradford Machine Tool Co., Dresses Machine Tool Co. and Greaves, Klusman & Co.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

A Vertical Miller

The illustrations show a new vertical miller, built by Kearney & Trecker, Milwaukee, Wis.

The spindle of this machine is not provided with vertical adjustment, all such adjustment being taken care of by the knee. The lubricating system is plainly shown in Fig. 2. It is the same as that employed in the horizontal-spindle machine built by this concern, but with such additions as are necessary to take care of the vertical spindle.

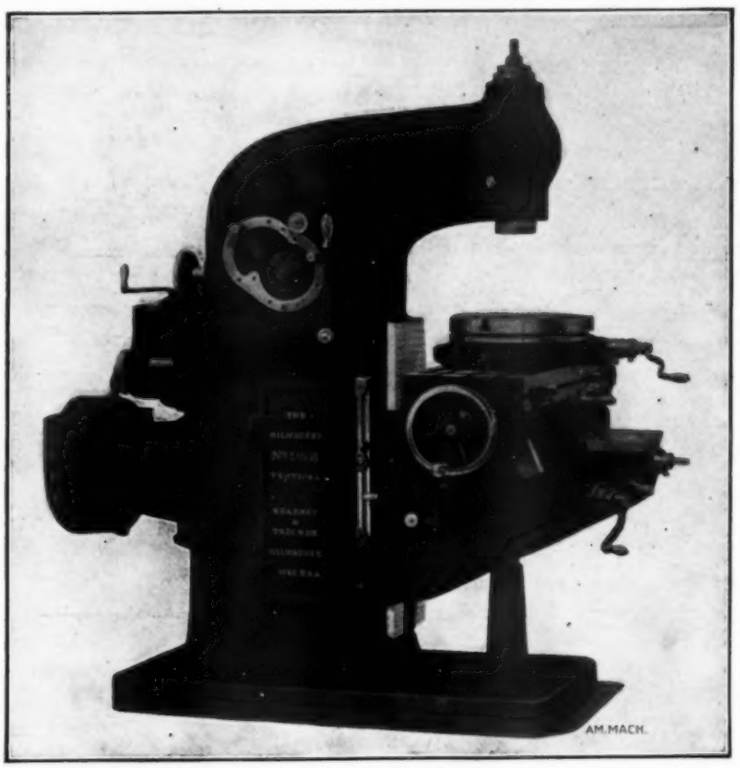


FIG. 1. A VERTICAL MILLER

The spindle boxes are of bronze, tapered, enabling the wear to be taken up by the collar at the upper end of the spindle. The oil is pumped up through the pipe *A* by a simple geared pump, located in the base of the machine. The perforated pipe *B* delivers oil to all of the horizontal bearings and gears. These are so constructed that the oil flows by gravity, downward from one bearing to another.

The bearings are grooved so that the oil can flow freely through them. The rapid flow of the oil tends to wash out any foreign substance which might lodge in the bearings. The surplus oil flows through the passages *C* and *D*, and through the horizontal opening *E*, connected with a vertical hole *F*, which is plugged at the top. The oil flowing through these passages lubricates the spindle bearings, the gears *G* and the pinion and pinion shaft.

The grooves in the upper spindle bearing are so disposed that the oil is carried upward into the annular groove *H*, and thoroughly lubricates the thrust collars and bearings. The oil flowing downward through the spindle bearings onto the collar *I* is prevented from reaching the end of the spindle by the collar *J*.

The spindle nose is provided with a hardened-steel driving collar, which is removable so that face cutters may be screwed solidly against the flat face of the spindle.

This machine has 18 spindle speeds in geometrical progression, running from 15 to 354 r.p.m., these 18 speeds being obtained by the use of 10 gears only, one of these being located on the shaft *K*, which engages with the middle step of the three-step cone *L*, which is an idler carried in the swinging frame *M* that is supported on one side by the shaft *K* and on the opposite side by a pinion, so that there is no overhang whatever to the idler *L*.

The three steps in the idler *L* are arranged so that they can be engaged successively with the gears *N* and *O*, which give six changes of speed. The spindle-sleeve gears *P* and *Q* are arranged to engage with *O* and *M*, and also slide into engagement with the pinion *P* on the

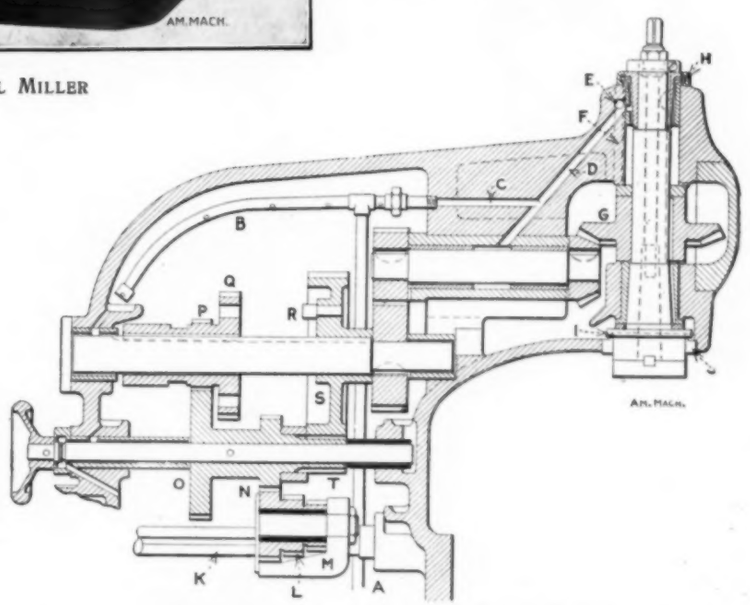


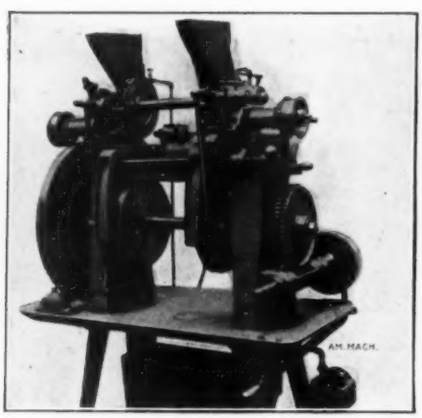
FIG. 2. DETAILS OF DRIVE AND OILING SYSTEM

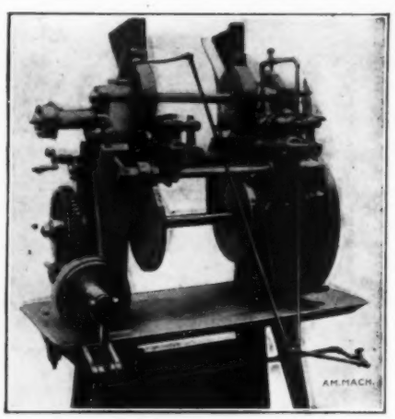
large drive gear *S*, which engages with the pinion *T* for slow speeds. This gives three changes of speed which, combined with the six obtained through the medium of the cone *L*, gives 18 changes of speeds, 10 gears only being employed.

The machine has an automatic table feed of 24 in., an automatic cross-feed of 12 in., and can be lowered 18½ in. from the end of the spindle, the vertical feed also being automatic. The work table has a working surface of 11½x38⅜ in. The rotary table is 14 in. in diameter on the working surface, 18 in. diameter over the oil pan and is 5 in. high. The driving pulley is 14 in. in diameter for 4-in. belt and runs 250 r.p.m. The pulley is guarded by a guard made of perforated sheet metal, so constructed that it can be turned to any position around the pulley, so that the belt can come from the line shaft directly overhead or from any angle, even through the floor from a line shaft underneath. No countershaft is employed with this machine.

Automatic Rod Driller and End Former

Figs. 1 and 2 show a special machine designed and built by the Langelier Manufacturing Co., Providence, R. I. The machine automatically rounds or chamfers both ends of the round rod and simultaneously drills a cotter-pin hole crosswise near each end of the rod. The machine can be adjusted to handle rods from ¼ to ½ in. diameter and from 3 to 13½ in. long. The output for rods if ⅜ in. diameter is 3½ per minute.





FIGS. 1 AND 2. FRONT AND REAR VIEWS OF THE DRILLER AND FORMER

The bed is mounted on a pair of legs. Midway up the legs is located the main camshaft, driven by a friction clutch pulley through a worm and gear. Upon the upper face of the bed and along its entire length is a dovetailed slide upon which the crossheads that carry the drilling and end-forming spindles and the feed hoppers are located. The left-hand crosshead is stationary and is fastened permanently on the end of the bed. The right-hand crosshead is movable along the slide and can be adjusted for different lengths of rods.

The drill heads seen in Fig. 2 are fastened one to each of the crossheads. The feeds to the drilling spindles are obtained from a horizontal shaft connecting both drill heads, upon which are fastened segment gears meshing with racks cut into the yokes of each drill head. The shaft obtains its movement through a cam lever from the inner face of the large face cam on the left-hand end of machine. This shaft also carries the two segment cams for actuating the feed to the end-forming spindles. The hopper feed consists of two triangular end guides located above each of the notched carrier disks that are mounted on a shaft having bearings through each of the crossheads, deriving its motion through a pawl and ratchet wheel linked to the outer face of the large face cam.

The notched carrier disks in passing the opening in the hopper guides allow the rods in the hopper to fall into the notches which in turn carry the rods to their respective drilling and end-forming positions. Each of the carrier disks has a rectangular slot cut into its outer face to allow the ends of vises to enter and bind the rod firmly while being drilled. These vises are located at the lowest notch position directly under the center of the disks and are actuated by the two face cams seen between the legs of the frame. These vises also serve as jigs for drilling the crossholes accurately in the rods.

The end-forming spindles are located on the front and the third notch up from the drilling position. Alligator jaws, fulcrumed to the bell-crank lever, and actuated from the camshaft are provided to hold the rods firmly while being operated on. The end-forming spindles running in opposite directions neutralize the turning effect on the rods. All connections to feed disks are flexible, so as to prevent any breakage in case the rods should happen to clog up in the hopper and not enter the notches properly.

The rods after being carried through the drilling and end-forming operations are carried up and ejected on the front of the machine. An automatic oil pump is used to force oil to the cutting tools. The oil and chips fall in cavities cast into the base of the crossheads. The oil is separated from the chips, is guided and falls into the lower oil pan where it is again filtered before entering the oil tank. The machine clutch pulley, drilling and end-forming spindles are each belted separately to an overhead countershaft. The action of the machine is continuous and automatic. The hopper is of sufficient capacity to run one hour without refilling. The floor space of the machine is 33x36 inches. Height, 5 feet.

A Multiple Spindle Driller

The halftone, Fig. 1, shows a multiple-spindle driller, manufactured by the National Automatic Tool Co., Richmond, Ind. These drillers feature independently changeable spindle speeds, which make it possible to run different-sized drills at the same time, each at approximately its proper cutting speed; see Fig. 2. The heads are either square or rectangular, and have drilling surfaces of 9¼x9¼ in. between centers, and 12x18 in. between centers, respectively. Both style machines are equipped with adjustable steel rails, the square-head machine having a capacity of ten ⅜-in. drills, or equivalent, and the rectangular head a

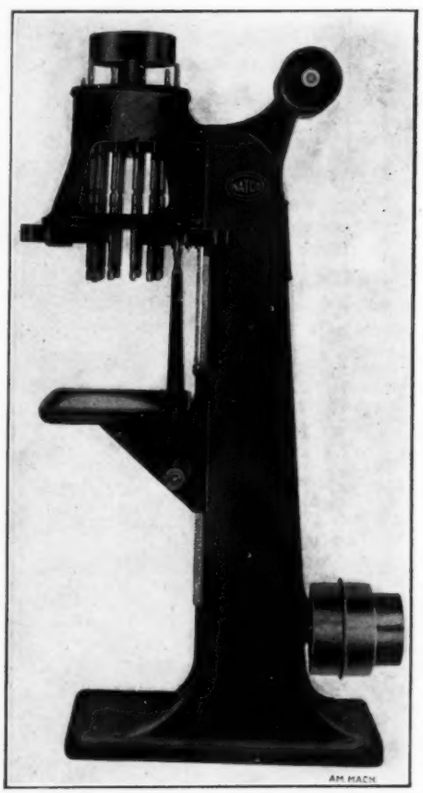


FIG. 1. A MULTIPLE-SPINDLE DRILLER

capacity of sixteen $\frac{5}{16}$-in. drills, or equivalent. The centers obtainable on either machine are $\frac{11}{16}$ and $\frac{13}{16}$ in., depending on the size of holes to be drilled. Machines with either single- or double-spindle speeds can be furnished.

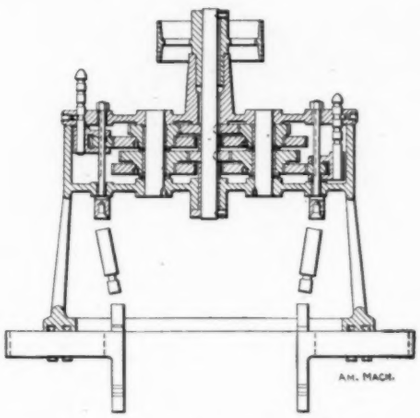


FIG. 2. THE CHANGE-SPEED MECHANISM FOR THE SPINDLE

All gears in the machine are cut and all head gears run in a continuous oil bath, the head acting as an oil reservoir. Ball bearings are used between the gears. All bearings are bushed with phosphor bronze. The adjustable steel rails are bronze bushed, have ball thrust, adjustment for wear and ample oiling facilities. They are quickly adjusted, in changing the machine from drilling one piece to another, over the entire range of the machine. Spring collets are used for holding the drills, which are held in position by a spindle cap, hexagon in shape, which screws on the end of the spindle.

In case the entire equipment of rails is not being used, those not in use can be thrown out of commission by raising or lowering the spindle gears into a neutral position, while the machine is running. The table is counter-balanced and has large bearing surfaces on the column with adjusting gib for wear. Either hand or power feed can be furnished. Stops are located on the side of column for drilling holes a certain depth. Automatic throwout is furnished with the power feed. The distance from the top of the table to the bottom of the largest spindle is 21½ inches.

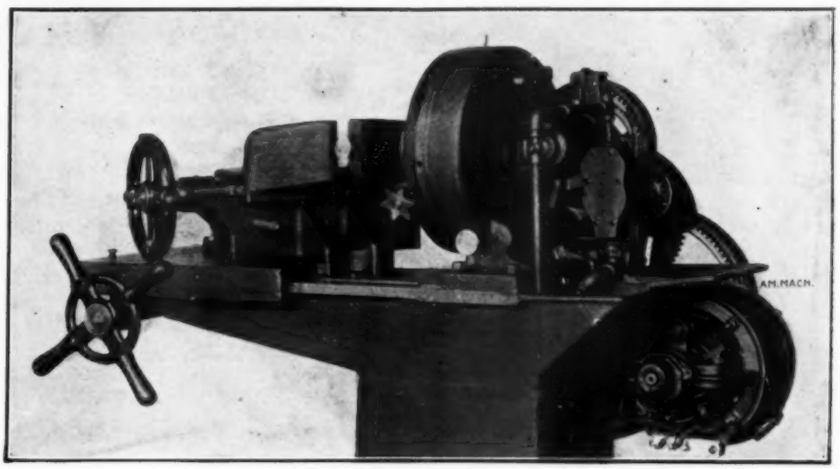
The table on the smaller machine has a planed surface 10¾x14 in., with an over-all surface of 14x18 in.; the table on the larger machine has a planed surface of 13x21 in., with an over-all surface of 16$\frac{5}{16}$x25 in. The oil groove around the table is finished level with the top of the table, and gives a larger working surface for handling the work, jigs, etc. T-slots for clamping jigs or work are furnished if desired. The machine shown, which is the smaller size, is 6ft. 8 in. high, and weighs about 1000 lb.

Bent Pipe Threader

The threader shown herewith is designed for threading straight or bent pipe from 6 to 24 in.; the latter is accomplished by swiveling the gripping jaws. The vise is locked in position and the pipe held in the vise jaws in the ordinary way. The curved slot in which this lock is placed is so graduated as to enable the operator to place the vise at any desired angle. When threading straight pipe, the vise is locked in its normal position.

The machine is equipped with an automatic knockoff.

These machihes are made regularly up to 2 in. by the Oster Manufacturing Co., Cleveland, Ohio.



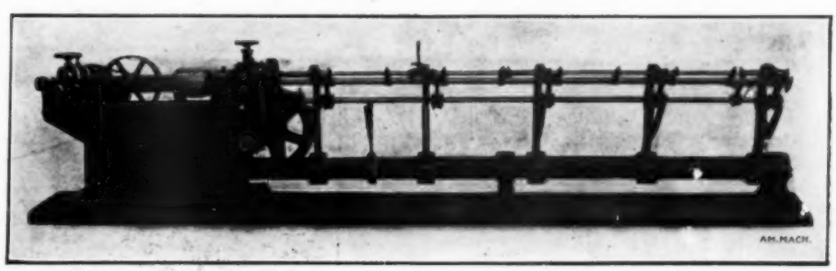
BENT-PIPE THREADER

Automatic Wire Straightener

The accompanying illustration shows a development of the automatic wire straightener and cutter built by the F. B. Shuster Co., New Haven, Conn.

The continuous feed is the special feature of this machine, and is fitted with an arbor and dies of such design that after they are once adjusted for a size of wire, the wire may be fed through without stopping the machine or readjusting the dies.

There is a clutch-trip which brings the cutting mechanism directly under the hand of the operator. This is controlled by means of the handle shown on the front of the machine. The three-roll back rough-straightener has double-grooved feed rolls the same as the front feed rolls, and is connected with the front feed by means of sprocket and chain. The machine is built in various sizes and lengths.



AUTOMATIC WIRE STRAIGHTENER

Cutting and Grinding Com pound

The Oakley Chemical Co., 114 Liberty St., New York City, has recently placed on the market a cutting and grinding compound under the name of "oakite." The compound is also used as a cleansing agency and has the peculiarity of not making suds.

The emulsion is not injurious to the hands and is devoid of any offensive odor.

Centering Tool

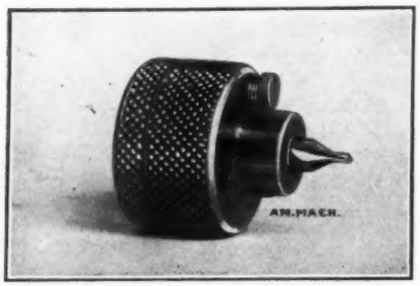
The centering tool illustrated is manufactured by Robert H. Fay, Chicopee Falls, Mass.

It is for use on a lathe or hand screw machine, eliminating the time in centering work held in a chuck by the usual method. This tool turns on the center when the drill becomes clogged, but remains stationary when the drill is cutting free.

The body of the tool is composed of two sections, one adjustable to the other,

and for convenience one is threaded into the other.

The forward end, which carries the center drill, has a hole the entire length,



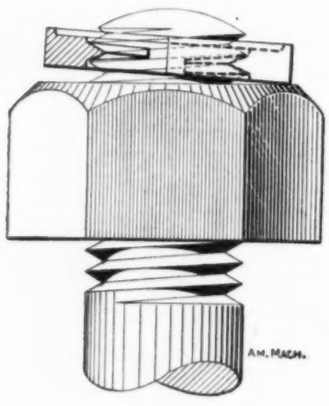
CENTERING TOOL

the rear end of which is beveled to 60 deg. The other section, which is in the form of a ring, is also beveled on the inside.

The two sections, when united within 1/32 in. form a 60-deg. angle from the small bevel to the large one, and when placed on a 60-deg. center both bearings are in contact with the center. It will readily be seen that by varying the distance between the bearings, the angle can be changed to more or less than 60 deg., thereby allowing it to be used on any 60-deg. center, or one that is more or less than 60 deg. through a reasonable degree of variation. A small locking screw locks the sections at any point. The tool centers the work without any means of steadying, and instantly locates the dead center of a whirling piece

Nut Lock

The nut lock shown in the accompanying illustration is a recent development of the United Nut Lock Co., Springfield, Mass.

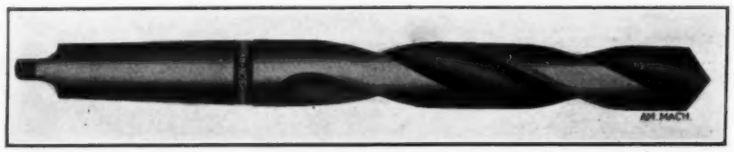


NUT LOCK

The tongues project into the center, engaging the bolt threads in opposite sides, thus combining a wedge and ratchet action in the bolt thread on the top of the nut. The principle on which it works is readily apparent from the illustration.

Forged Twist Drill

The accompanying illustration shows a form of hot-forged twist drill recently developed by Joseph T. Ryerson & Son, Chicago, Ill.



RYERSON-RICH FORGED TWIST DRILL

It will be noted that it resembles a regular milled type of twist drill and that the chief difference is therefore in the process of manufacture.

The shanks are furnished with regular taper or with one size larger than standard, when desired for extra heavy feeds.

A Turbine Engine

The components of a new engine are shown in Figs. 1 and 2. This is the invention of John H. Van Deventer, superintendent of the Buffalo Forge Co., and is being put upon the market by that company under the name of the "Spiro."

If a pair of spiral or herringbone gears are held together as in Fig. 1, there will be found to be a lozenge-shaped pocket in the center, as shown. If the gear is revolved, this space is extended, and as the teeth inclosing it advance to the respective positions, the volume will be increased.

A fluid under pressure admitted to the space *A* in the center and acting upon the receding surfaces would drive the gears, the energy produced being equal to the product of the pressure and the volume generated. If the driving fluid were expansible and were cut off at any point, it would expand into the increasing volume, and the advantages and economies of expansion be realized just as in a cutoff engine working with a regular piston. When the ends of the grooves in which the action occurs pass the line of contact, so that they are no longer closed by the teeth of the opposite gear, the fluid would exhaust.

It is upon this principle that the "Spiro" acts. The operating fluid is admitted through ports, no nozzle or other means is used for inducing velocity, and the width of the entrance port in the axial direction determines the point

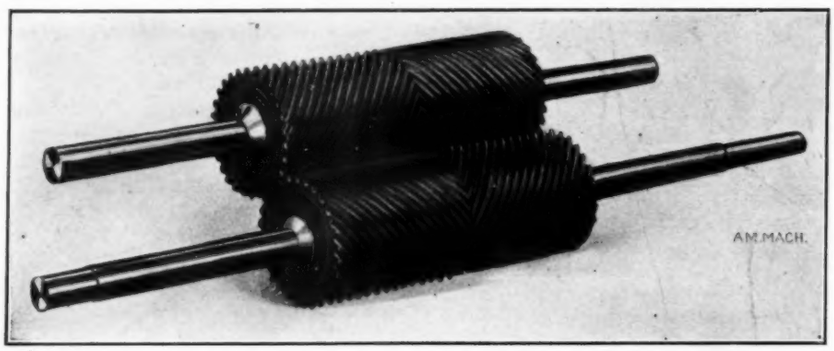


FIG. 1. THE ROTORS

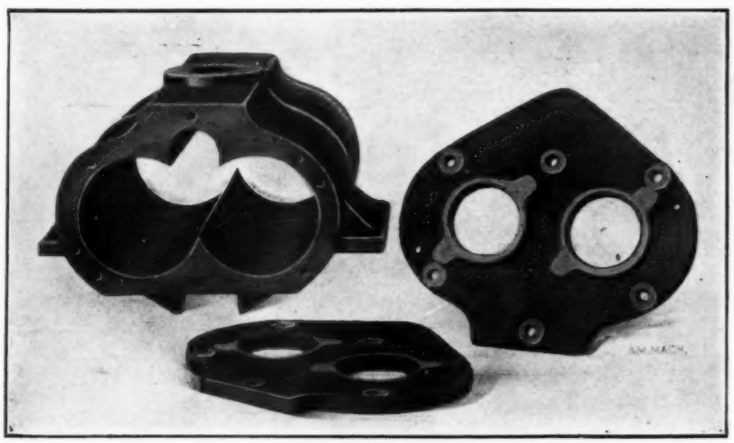


FIG. 2. THE CASING AND COVERS

of cutoff. The regulation may be effected by varying the cutoff by an adjustable port, or by throttling, inclosed forms of both types of governors being furnished.

The secret of the large capacity of this little motor lies in the large displacement afforded by its numerous chambers and the high velocity at which their volume is increased. It is possible, therefore, to get a large amount of power with pure rotary motion, into a small weight and space, with no pistons or abutments, and with no necessity for packing. The surfaces of the teeth, as the gears drive each other, run in sufficiently close contact to preclude serious leakage; leakage between the tops of the teeth and the casing is minimized by the small pressure difference between contiguous grooves; what steam is present between the teeth forms an elastic cushion reducing the tendency to wear. The contact pressure imposed upon the teeth does not exceed five pounds per square inch, which is very small compared with that used with gears designed for power transmission. The ends being in the exhaust chambers, do not need to be packed.

The "Spiro" is to be built in sizes all the way from small units—which may be held in the hand and used to operate drills and other air-driven tools—up to those of several hundred horsepower. The small hand motor will drill a one-quarter inch hole in hard cast iron at the rate of one inch in twelve seconds.

Efficiency in the Drafting Room

By Entropy

Efficiency in the drafting room! I thought that was going to be the one place where efficiency would not hit. If a border line cuts off 15 per cent. of the area of the paper used and uses 2¼ per cent. more ink than is necessary, how much can the efficiency of the drawing room be increased by compelling all draftsmen to forego "biled" shirts, collars and cuffs, and requiring them to shave only once a week? I have made something like an acre of drawings without border lines, but it was in a place where a man would as soon go to work in a dress suit as wear cuffs.

Efficiency in Care

Seriously, however, does not real efficiency in the drafting room imply going slow? Not dawling, but the most minute and painstaking care. When we consider the cost of getting out a sheet, even of details, it looks like a pretty big expense, but, on the other hand, the material alone that may easily be wasted in order to find out that a single dimension on that sheet is wrong, will usually pay for a lot more time than was put into it. A human being is most woefully apt to trip up and make mistakes, no matter how careful he may be. In fact, the more concentrated care is given under pressure the greater the likelihood there is of errors creeping in. Drafting-room efficiency has no connection with speed. I question the desirability of keeping time cards in a drafting room at all. It may be interesting at some time to find out how much money was sunk in getting out the first model of some new machine, but it does not aid in determining the probable future cost of manufacture to know that Bill Jones spent 3 hours and 12 minutes drawing the upper left-hand flipper. What is interesting is to know whether the aforementioned Bill noticed that when he got the drawing done that particular flipper could not be put into place without sawing it in two and gluing it together by some process of autogenous welding. In an hour a single draftsman, without the slightest mental effort, can ball up a whole shop so tight that all the rest of the force will have to spend a week placing the responsibility.

Stimulating the Draftsman

The thing which does seem to me to be an open question is that of artificial aids to the draftsman—aids that enable him to give more concentrated attention to his work with less weariness, for if there is any man around the job that the proprietor cannot afford to have go home at night tired out, it is a draftsman. A tired man in the shop is not very likely to injure anyone but himself, but a tired draftsman is almost sure to mix up dimensions or do some other fool stunt that will put a lot of useful work in the shade.

The most noticeable of the aids are: Good air, good light and a gentle hum of industry. The most important and the least observed is, I believe, a head draftsman who is not cranky. This seems to be a most difficult place to fill, for the man with a real mechanical genius is apt to be slightly unbalanced in regard to his fellowmen. If he were not he would have a bigger job.

Fraternizing Outside the Shop

That brings me to a plea for a more active association of men in and outside the shop. The average mechanic, whether in the machine shop as a workman or foreman, or in the drafting room, is a hermit. He will not believe it when you tell him so, but just try to get him to crawl into his best clothes and go out with you to some meeting—scientific, religious, political or whatever it may be. Does he stir? Not perceptibly, except to shrug his shoulders and mention that he would rather take his chances on the climate in the next world than to be seen going out evenings.

I do not mean by this that it behooves a machinist to go to cheap dances and moving-picture shows, but that he would be infinitely better off if he went somewhere where he would discover that the boss hasn't all the brains in the world, and find out what is going on outside the four walls of the particular shop he is working in. To places where he could observe that men are men and learn how to handle them as equals, and how little he can rely on them in small matters, and how much in large ones.

What our mechanics, and our draftsmen especially need, is broader contact with men and affairs, and less herding away by themselves. If they would do this it would enable them to get the "knack of explaining" that Mr. Bacon comments on, on page 1083. All there is to explaining anything is simply to know what you are explaining, which is the first snag that most of us strike, and then to have a fairly ordinary command of the English language. This latter would be expected of any technical graduate, and of most high-school boys, but possibly we all will agree that it is lamentably lacking in both.

Acquiring a Vocabulary

This is not strange when we look into English as it is taught, for it is the exception to find a school where any attention is paid to expression or description in technical language. For anyone who has passed the school stage, I would suggest beginning to write for the technical papers. They will correct the English and the expression, and use the article if it has anything in it except words, and comparison of the published article with the original copy will reveal just wherein the editor differed from him. I do not just now think of any other way in which a liberal and paid-for education in English can be obtained.

Jigs for Finishing Roller Socket Stems

By Harold E. Murphy

In the accompanying cuts are shown two milling and one drilling fixture for machining form, roller-socket stems used on printing presses. The usual shop routing of these pieces is as follows: The stems are first turned in a lathe and squared on one end; then sent to the driller and drilled one at a time, after which they are sent to another department and the holes reamed to size by hand. Next they go back to the lathe, are placed on a mandrel and squared up one at a time, and finally they are slotted out on a miller.

It will readily be seen that considerable time is lost through this process. A better method is to first turn the stems in a lathe as usual, and then place them in the milling fixture shown in Fig. 1 and face on both sides at once with straddle

mills. This fixture is of cast iron and machined only where necessary and is held to the miller table in the usual way by means of T-bolts and nuts. It has 9 studs, 3 on each end and 3 in the middle, screwed into the base to hold the clamping straps *A*, which hold the stems in position while machining. These straps are slotted at the sides as shown, so that the clamping nuts need only be slightly loosened in order to remove the straps from the studs.

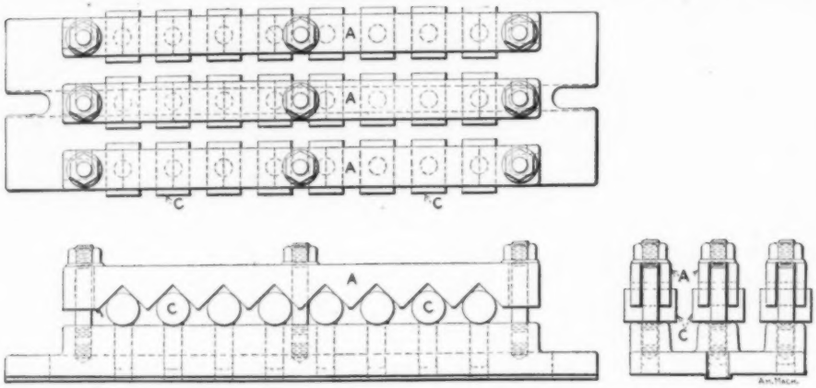


FIG. 1. JIG FOR MILLING ENDS OF ROLLER-SOCKET STEMS

The clamping plate itself has four small hook-shaped studs for holding it in position and also to provide for easy removal. The bushings are of the slip-bushing type, so that after the drilling operation they can be removed and the stems machine-reamed while in the fixture, insuring a straight hole.

The final slotting of the pieces is done while they are held in the jig shown in Fig. 3, which is designed to hold 14 stems, seven straight and seven offset ones. The working of this fixture is simple, the stems being inserted in their respective places and the setscrews tightened. These setscrews come against split bushings which do not injure the stems.

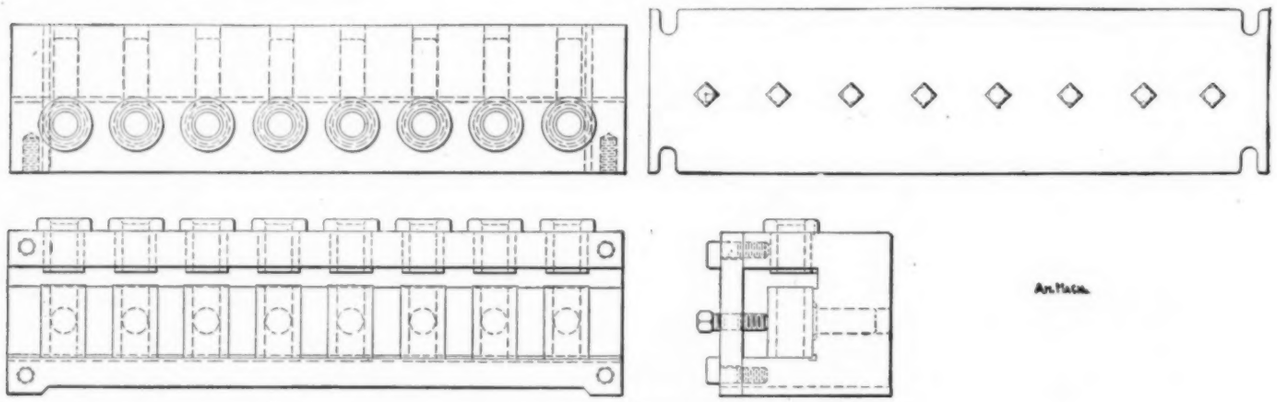


FIG. 2. THE DRILLING JIG

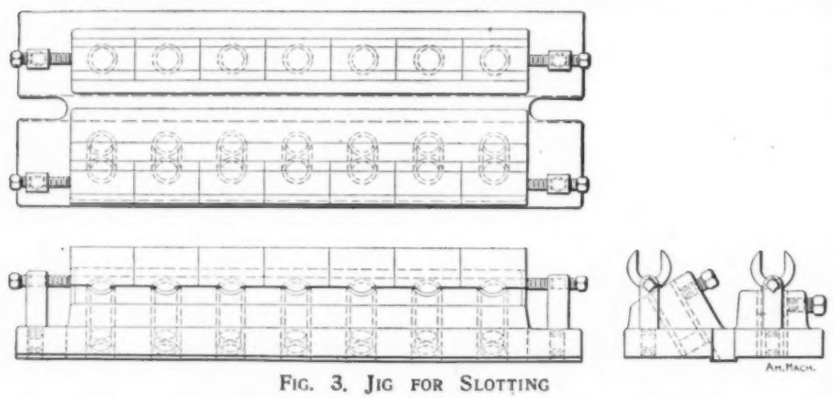


FIG. 3. JIG FOR SLOTTING

After being milled the stems are sent to the drillers and placed in the jig shown in Fig. 2, which holds 8 stems at one setting. The jig is of the box type with a clamping plate as shown, with setscrews for holding the stems in place.

From the foregoing it is readily seen what can be accomplished by these fixtures and how much cheaper these stems can be manufactured by this method as compared with the old process.

Boring and Threading Nuts

BY FRANK ROSE

A newcomer in the shop, a brignt young foreigner, probably of Russian birth, attracted my attention lately, by his ability to devise and execute original methods of doing work which never occurred to the rest of us. One of his star performances was in the threading of a large number of thin brass nuts. His method may interest some of your readers.

The nuts were for 2-in. heavy brass tubing, used for a special purpose. They were to be cut, to screw on hand-tight, the thread being U. S. standard. The nuts were but ½ in. thick. We were in the habit of boring and threading one at a time. They required no facing. He used a universal, three-jaw chuck, and tried cutting two nuts at once. Finding it successful, he tried three the next time. He then continued boring and threading three at a time, until all were completed. He finished the job in less than half the time it usually took, and neither hurried nor slighted the work in any way.

After the experience in cutting the heavy steel bars which guarded the windows of the Equitable Building with a hacksaw in order to rescue men in the cellar, the New York Fire Department has ordered portable oxyacetylene outfits for the down-town districts. With the mercury hovering around zero, the hacksaw is a very slow proposition, particularly for the man whose life depends on the bars being sawed before the fire reaches him. This is supposed to be the first instance of these outfits being used by fire departments.

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

METAL WORKING

NEW ENGLAND

The city of Worcester, Mass., will require a small machine shop and traveling crane.

Fire destroyed the carriage shop of Abraham Jones, West Hartford, Conn., causing a loss of $8000.

Worcester Pressed Steel Co., of Worcester, Mass., contemplates the construction of a large rolling mill and the installation of new machinery.

Private plans are being prepared for a rolling mill which the Worcester Pressed Steel Co. contemplates erecting at Greendale. It will be about 100x200 ft., two stories high.

The Westfield Foundry & Valve Co., Westfield, Mass., manufacturer of heating appliances, etc., will double the capacity of its plant. C. O. Churchill is president and secretary.

A. C. Swan & Co., Norwich, Conn., have purchased the W. A. Holt property on Main St. It is the purpose of the new owners to build a large one-story garage, of brick, on the site.

Estimates are being received for the addition to the factory of the C. G. Garagus Machine Co. on Riverside Ave., Bristol, Conn. There will be a three-story brick addition, 25x40 ft.; also boiler room, 46x22 ft., and 20 ft. high. The foundations are completed. Sperry & Buell, Inc., of New Haven and Bristol, are Archs.

MIDDLE STATES

The plant of the Home Furnace Co., Cleveland, Ohio, has been destroyed by fire.

The Baldwin Locomotive Co. is erecting a large addition to its plant at Eddystone, Penn.

The Chicago (Ill.) Dock & Canal Co., 213-17 East Illinois St., will build a six-story brick factory.

The Home Furnace Co., Cleveland, Ohio, manufacturer of house furnaces, was destroyed by fire.

The Pullman Co., Pullman, Ill., will install new machinery in the steel-car department of its plant.

The Pittsburgh Nut & Bolt Co. will install a new outfit of machinery and tools at its works at Gary, Ind.

The Commerce Motor Car Co., Detroit, Mich., is planning extensions to its plant and additions to its equipment.

The boiler room and generating plant of the Pastor Coal Co., at Wellston, Ohio, was destroyed by fire on Jan. 10.

The plant of the Globe Malleable Iron Works, Syracuse, N. Y., was destroyed by fire, Jan. 23. Loss, about $60,000.

The Wheeling Corrugating Co., Chicago, Ill., is building a two-story factory to cost $150,000, at Harvard and Rockwell Sts.

H. Ley & Co., manufacturing structural and ornamental iron work, has completed plans for a new factory at Cincinnati, Ohio.

Patten Bros. & Co., Marietta, Ohio, will build a factory, at Tulsa, Okla., for the manufacture of gas engines and gas-engine appliances.

Fire caused $10,000 damage to the mill of the Forge Wheel Co., a subsidiary of the Standard Steel Car Co., at Lyndora, near Butler, Penn.

A new steel plant to be called the Brier Hill Steel Co., will be built at Youngstown, Ohio. The Thomas Steel Co., Niles, Ohio, is interested.

The plant of the Evans Manufacturing Co., at Hammond, N. Y., manufacturing farming implements, has been destroyed by fire. Loss, $40,000.

The Modern Machine Tool Co., of Cincinnati, Ohio, will enlarge its plant and purchase new equipment. George Atkinson is president and Joseph S. Logan secretary.

The Alvey-Ferguson Co., manufacturing conveying machinery, has let a contract for a large addition to its new factory, at Oakley, Ohio, to the Allyn Engineering Co., Cincinnati, Ohio.

The Apollo Garage, 1117-39 North Clark St., Chicago, Ill., has been purchased by J. C. Loeffel, who will have same fitted with cement floor, heating apparatus and will also install a machine shop.

Plans are being prepared by the H. K. Porter Locomotive Co., Pittsburg, Penn., for extensions to its works, which will largely increase the capacity of the plant. Bids for the construction work will be asked for immediately.

Equipment is being installed by the George Automatic Roller Bearing Co., in its new factory, at Hamilton, Ohio. This concern will make roller bearings for automobiles and general machinery purposes. Isaac A. George is manager.

The borough of Emaus, Penn., will receive bids until 8 p.m., Feb. 5, for the installation of a double-action pump, with a speed of from 50 to 100 rp.m. and capable of delivering from 200 to 400 gallons of water per min.; also for one 80-hp. horizontal-tubular steam boiler, 150 lb. pressure, including all necessary fittings, stack, stack plate, feed-water heater of sufficient size and injector.

SOUTHERN STATES

The Ellicott Machine Co., Baltimore, Md., will erect an addition 50x160 ft. to its machine plant.

The Eureka Stove Works, Birmingham, Ala., will rebuild its plant recently destroyed by fire. The new plant will include foundry, erecting shop, pattern shop, etc.

The Myers-Whaley Co., Knoxville, Tenn., manufacturer of tunneling and moving machinery, has increased its capital $100,000 to provide for an increased capacity of its plant.

The Crown Cork & Seal Co. has awarded a contract to Monmonnier & Sorrell for alterations and improvements to the chemical laboratory and machine shops on Guilford and Girard Aves., Baltimore, Md. Plans were drawn by C. M. Anderson, 324 North Charles St., Baltimore, architect.

WEST OF THE MISSISSIPPI

The Huber Machine Co., Lincoln, Neb., is enlarging its plant.

The Parsley-Paine Manufacturing Co., which manufactures monkey wrenches, will enlarge its Crockett (Tex.) plant.

PACIFIC COAST

The Motor Car Agency, Seattle, Wash., will build a new commercial garage and repair plant.

The Kent-Marvin Co., Bellingham, Wash., will acquire a new site and erect machine shops.

The General Fertilizer Co., San Bernardino, Calif., will build a new grinding and mixing plant. About $20,000 will be expended.

The Sterling Steel Co., Los Angeles, Calif., contemplates the erection of a new manufacturing plant at Pomo, Calif. H. W. Sterling is president.

The machine shop and pipe foundry of the Oregon Iron & Steel Co., Oswego, Ore., was destroyed by fire, with a loss of about $50,000. The plant will be rebuilt. W. M. Ladd is president.

Work has been started on the grading work on the site of the proposed new roundhouse for the Northern Pacific Ry. Co., at Centralia, Wash. I. B. Richards is general superintendent, Tacoma, Wash.

CANADA

The Mechanics Supply Co., of Quebec, Que., will equip a plant at Quebec.

Brown, Boggs & Co. will build a new $200,000 machine plant, at Hamilton, Ont.

The Oliver Chilled Plow Works, of Hamilton, Ont., will erect additions to their plant.

The Algoma Steel Bridge Co., Winnipeg, Man., will locate a large factory at Winnipeg.

The Canadian Talbot Boiler Co., New Westminister, B. C., will equip a large new plant.

Additions will be built to the plant of the Dominion Rock Drill Co., Ltd., Napanee, Ont.

Machinery is required for the machine shop of the Ford Smith Machine Co., Hamilton, Ont.

F. V. Samwell is head of a company which will equip a large new tube mill, at Fort William, Ont.

Hoffmeister Bros. will equip a large new garage and repair shops, at 1155 Pender St., Vancouver, B. C.

Contract has been awarded for a $10,000 factory for the Brantford Oven & Rack Co., Ltd., Brantford, Ont.

The Hamilton Steel Co., Hamilton, Ont., will enlarge its plant and install more machinery. Robert Hobson is manager.

The Imperial Wire & Cable Co., Montreal, Que., have purchased several acres of land at Highlands, near Lachine, Que., as a building site for a new factory.

A contract for connecting the water system of Victoria, B. C., with Sooke Lake has been awarded to the Westholme Lumber Co., Ltd., of Victoria, at $1,169,720.

The Jewel Carriage Co., Carthage, Ohio, has organized a Canadian branch, with $700,000 capital, and will build a new factory on the border for the manufacture of motor cars. The exact location is not determined. C. F. Pratt, Cincinnati, Ohio, is president.

General Manufacturing

NEW ENGLAND

The Common Sense Gum Co. has erected a new factory at Newport, R. I.

The Stamford Chemical Plant, Stamford, Vt., recently destroyed by fire, will be rebuilt on an enlarged scale.

A new storehouse is being erected by the Saunders Cotton Mills, Saundersville, Mass. It wil be 52x125 ft., two stories high.

The mills and offices of the William S Allen Co., West Stewartstown, N. H., were recently destroyed by fire, causing a loss of $50,000.

The Middletown Electric Light Co., Middletown, Conn., will build an addition to its plant. The boiler-room capacity, engines and machinery will be doubled.

The new mill being erected on Dwight St., Holyoke, Mass., for Wiliam Skinner Manufacturing Co., is now being finished. It will be 60x280 ft., four stories high.

The Draycott Mills Co., New Hartford, Conn., is contemplating the erection of a large brick mill. Lockwood, Greene & Co., 93 Federal St., Boston, are the Archs.

The Winchester Repeating Arms Co. have filed plans, with the building department of New Haven, Conn., for an addition, 31x45 ft., two stories high, to its plant.

It is reported that the J. N. Lapointe Shoe Co., Westboro, Mass., contemplates the erection of a new factory on Manning St. It will probably be about 200 ft. long and two stories high.

The Standard Laundry Co., New Haven, Conn., has been incorporated with $30,000 capital to conduct a laundry. The incorporators are Frank A. Leddy, Wm. E. Leddy and Alexander Troup.

Work will be started in the spring on the new factory building on Stillman St., Bridgeport, Conn. for the Boone Folding Box & Printing Co., 137 Cannon St. The building will be 25x50 ft., three stories, of brick. A freight elevator will be needed.

The Bias Narrow Fabric Co. will erect a new manufacturing building at the corner of James St. and Linen Ave., Bridgeport, Conn. It will be of brick, and will contain about 25,000 sq.ft. of manufacturing area. McClintock & Craig, Springfield, Mass., are the Archs.

A large addition to the plant of the Touraine Co., lace manufacturers, New Hartford, Conn., is being contemplated. The new building will be 56x250 ft., one story high, of reinforced concrete, and will be used as a weave shed. Lockwood, Greene & Co., 93 Federal St., Boston, Mas., are the Archs.

MIDDLE STATES

Wellsville, Ohio, is planning to erect a municipal electric-light plant.

The Home Preserving Co., Indianapolis, Ind., will install new equipment.

The Hoffman & Penn Wagon Shop, at Ripon, Wis., was burned. Loss, $4000.

Fire destroyed the Globe Malleable Iron Works, Syracuse, N. Y. Loss, $60,000.

Fire destroyed a large part of the plant of the Cleveland (Ohio) Woolen Mills Co.

The plant of the New Jersey Oil & Meal Co., Jersey City, N. J., was destroyed by fire.

The Ohio Machine & Boiler Co., of Cleveland, Ohio, is erecting additions to its power plant.

The Sibley Lumber Co., of Detroit, Mich., will make additions to its power-plant equipment.

Fire destroyed the roller mills of the Adam Kuehlthau Estate, at West Bend, Wis. Loss, $30,000.

The Kokomo Asphalt Paving Co., of Kokomo, Ind., has been incorporated to do a paving business.

The addition to the Daniel Green Felt Shoe Co.'s factory, at Dolgeville, N. Y., is nearing completion.

The Elite Novelty Co., Winsted, Conn., manufacturer of novelties, will move its plant to Newark, N. J.

The Orinoko Mills, Philadelphia, Penn., will build a five-story factory on Ruth St., at a cost of $20,000.

The plant of the Schenectady (N. Y.) Bedding Co., mattress makers, was destroyed by fire. Loss, $4000.

Fire in the bed factory of the Hard Manufacturing Co., 117 Tonawanda St., Buffalo, N. Y., did $2000 damage.

The East Liverpool (Ohio) Ice Co. will erect a modern ice plant of 50 tons capacity. Estimated cost, $60,000.

The Maxwell Broom Factory, of Logansport, Ind., manufacturer of brooms, was destroyed by fire on Jan. 18.

The plant of the Petoskey Dye Works, at Petoskey, Mich., was destroyed by fire on Jan. 11, causing a $20,000 loss.

The Webster-Citizens' Ice Co., Buffalo, N. Y., has filed plans for a $15,000 ice-manufacturing plant on Gillett St.

The brewery of Gottlieb Schanz, Quincy, Ill., was destroyed by fire and all machinery ruined. Loss, $25,000.

The Cross Laundry Co. has awarded a contract for the construction of a factory on Elizabeth St., Detroit, Mich.

Fire destroyed the factory of E. F. Heath & Son, Warren and Wilson Sts., Newark, N. J., causing a loss of $5000.

The flour-milling plant, owned by George Allen, at Capac, Mich., was destroyed by fire on Jan. 11. Loss, $20,000.

The plant of the Rockford Desk Co., Rockford, Ill., was recently destroyed by fire. The loss is estimated at $200,000.

The Riverside Paint Manufacturing Co., 2001 Mendel Ave., Chicago, Ill., will erect an addition to its factory, costing $12,000.

The Peerless Silk Hosiery Co., Philadelphia, Penn., is having plans prepared for a four-story, 45x90 ft., addition to its plant.

The Retail Butchers Association, of Cleveland, Ohio, will erect a slaughter house equipped with modern slaughtering appliances.

The Plaut-Butler Co. has acquired additional space adjoining its present shoe factory in Cincinnati, Ohio, and will increase capacity.

The Ranwald Ecclesiastical Art Manufacturing Co., Milwaukee, Wis., will erect a three-story factory addition at 522 Sixteenth Ave.

The J. L. Schwartz Brewing Co., Buffalo, N. Y., has let the contract for a $50,000 addition to its refrigerating plant and bottling works.

The Central Casket Co., Buffalo, N. Y., has completed plans for the erection of a two-story brick factory at 100 Manitoba St. The cost is $20,000.

The King Top Co., of Dayton, Ohio, manufacturer of auto tops, will move into larger quarters and will then manufacture automobile truck bodies.

The Advance Glass Co., Utica, N. Y., will begin immediate construction of a factory at Newark, Ohio. The Utica factory was destroyed by fire recently.

It is reported that three acres of buildings, comprising the plant of the Commercial Acid Co., East St. Louis, Ill., have been destroyed by an explosion.

The Erie Gas Co. will build a new plant at the foot of Sassafras St., Erie, Penn. The building will be two stories high, 100x200 ft., on a concrete foundation.

Plans are being made by the Crosset Concrete Co., Binghamton, N. Y., for the construction of a two-story factory, 30x100 ft., for the manufacture of cement blocks.

The plant of the New Aetna Cement Co., of Fenton, Mich., was partially destroyed by fire, Jan. 14. Its power plant was totally destroyed. O. J. Singeman, general manager.

The Wheeling Coal & Coke Co. has placed an order with the Erie City Iron Works, Erie, Penn., for the installation of an Erie City engine, direct-connected to a 150-kw. generator.

The Buckeye Match Co., Toledo, Ohio, is to be reorganized under the name of the Pan-American Match Co. James P. Klotz, Toledo, will be at the head of the new concern, which will enlarge its plant.

The Indiana National Life Insurance Co., Indianapolis, Ind., has purchased ground in North Meridian St., and will erect a modern eight-story office building to cost above a half-million dollars. The building will have its own water, light and heat plant, also a vacuum-cleaning system. Work is to begin in the spring.

The Geneva (N. Y.) Gardens & Lime Co., capitalized at $225,000, has been incorporated, taking over the Flint Cement Co.'s holdings and purchasing addition marl beds in the vicinity of Gorham. Cement will be manufactured. The directors are James M. Kennedy, Henry F. Nester, Lansing G. Hoskins, Fitzhugh McGrew, of Geneva, and Henry M. Glen, of Seneca Falls.

SOUTHERN STATES

The Stokes Coffee Co., New York, N. Y will erect a large plant in Baltimore, Md.

Littleton, N. C., will issue $10,000 bonds for improvements to its electric-light plant.

Extensive additions will be made to the plant of the J. S. Young Co., manufacturer, Baltimore, Md.

The Menzel Box Co., Winston, N. C., will erect a three-story reinforced concrete factory to cost $70,000.

The Tomlinson Chair Manufacturing Co., High Point, N. C., is erecting a five-story brick factory to its plant.

The planing mill of the Robinson Planing Mill Co., Meridian, Miss., was destroyed by fire at a loss of $5000.

The Southern Manufacturing Co., Gadsden, Ala., has awarded contracts for machinery to be used in its new plant.

The Clarke Frame Cloth Mill, Johnsboro, N. C., has been sold to Eugene Irwin, who will put it into operation at once.

The Buck Glass Co., Baltimore, Md., has purchased a site, 55x155 ft., at Boyles and Clem Sts., and will erect a plant.

All the machinery of the Maryland Granite Co., at Guilford, Md., was destroyed by a fire, which wrecked the entire plant.

The machinery of the Baltimore Oakum Co., Fleet and South Luzerne Sts., Baltimore, Md., was badly damaged in a recent fire.

The American Radiator Co., Birmingham, Ala., will construct a plant for the manufacture of heating equipment, to cost about $1,000,000.

The Patton Aeroplane Co. has been capitalized at $60,000, and will erect a plant for the manufacture of aëroplanes, at Birmingham, Ala.

The Chesapeake Iron Works has been awarded the contract for the construction of a machine shop for the Elliott Iron Works, Baltimore, Md.

John Dunkin and Ralph Jones, Bridgeport, Ohio, are interested in the formation of a company to manufacture lamp chimneys, at Clarksburg, W. Va.

C. R. Merritt, Mt. Airy, N. C., contemplates the establishment of a plant for the manufacture of woolen blankets, and is in the market for machinery.

E. A. Smith, Charlotte, N. C., is at the head of a company recently incorporated, which will erect a large mill for the manufacture of fine cotton goods.

Catawba Ice & Cold-Storage Co. will erect a 75-ton ice plant and cold-storage plants at Spencer and Salisbury, N. C. Will install 25-kw. dynamos. D. J. Rose, Rocky Mount, N. C., is the architect.

The Wainwright-Ayers-Carroll Co., Norfolk, Va., has been incorporated to engage in the fish and oyster business. T. W. Carroll, Charleston, S. C., is president.

Fire destroyed the five-story plant of Binswanger & Co., Inc., manufacturers of builders' supplies, Richmond, Va. The loss is estimated at $170,000, much of which was caused by wrecked machinery.

WEST OF THE MISSISSIPPI

The Cargiell Elevator, Langdon, N. D., was destroyed at a loss of $40,000.

John Austin and James F. Smith, Hot Sprngs, Ark., will establish a plant for the manufacture of gas burners.

The Starr Pottery Works, San Antonio, Tex., has increased its capital stock to $50,000, and will make improvements to its plant.

In connection with its new hotel building the Salt Lake Brewing Co., Las Vegas, Nev., will build a modern cold-storage plant.

The Wier Wardrobe Co., Macon City, Iowa, whose plant was recently destroyed by fire, has decided to rebuild at a cost of $50,000.

The mill of the Arkansas Cotton Oil Co., Texarkana, Ark., was recently destroyed by fire and will be rebuilt at a cost of $130,000.

Machinery will soon be installed in the sewage-disposal plant at El Paso, Tex. The city has just finished extending the sewer system 1500 ft.

The Coleman Vitrified Brick Co., Coleman, Tex., will establish a large brick-making plant. The incorporators are J. T. Morris and C. C. Frampton.

The Saskatchewan Flour Mills Co., New Prague, Minn., is receiving bids for the construction of a six-story mill, 54x112 ft., and also a large oat mill and warehouse.

The Southern Engineering Co., Houston, Tex., has been awarded a contract by the Waco (Tex.) Sash & Door Co. for the construction of a plant costing $150,000.

PACIFIC COAST

Frank Peacock will erect a creamery, 27x27 ft., at Holtville, Calif.

The Lodi (Calif.) Coöperative Winery will erect a wine-making plant.

The Standard Oil Co. will erect a new pumping plant, at Vallejo, Calif.

The Sunset Lumber Co., Oakland, Calif., will make additions to its plant.

Strouse & Begg, Olympia, Wash., will establish a modern grain-milling plant.

Frank Peabody, Holtville, Calif., plans for the erection of a new creamery plant.

The Fleischmann Yeast Co. will erect a plant costing $150,000, at Sumner, Wash.

The city of San Bruno, Calif., plans for the installation of a new sewerage system.

W. L. Chenoweth, Hagerman, Calif., contemplates the installation of a pumping plant.

Meredith Bros., Bothell, Wash., will soon commence the erection of a sawmill at Bothell.

The city of Union, Ore., will make improvements and additions in its waterworks system.

The Bandon (Ore.) Light & Water Co. will make improvements in its waterworks system.

The Anacortes (Wash.) Water Co. will make improvements and additions in a local water plant.

The Porter Fish Co., Anacortes, Wash., plans to increase the capacity of its fish-canning plant.

The Lake County Canning Co., Santa Rosa, Calif., will build a new fruit-canning plant, at Ukiah.

J. S. Nolte and S. H. Bardman, San Francisco, Calif., will build a new planing mill at Stockton, Calif.

The City Electric Co., Shreve Building, San Francisco, Calif., will build an electric substation, on Folsom St.

The Southern Sierras Power Co., Los Angeles, Calif., will build a new electric substation at Perris, Calif.

The city of Avalon, Calif., contemplates the erection of a gas plant. The Board of Freeholders is in charge.

The Crown Laundry & Cleaning Co., Los Angeles, Calif., has taken out a permit to build a new laundry plant.

The Northern California Power Co., Princeton, Calif., contemplates the erection of a new substation at Princeton.

T. Bedecarrato, California St., San Francisco, Calif., has taken out a permit for improvements in his laundry plant.

The Pacific Coast Condensed Milk Co., Seattle, Wash., plans for the erection of a new plant, near Sedro-Woolley, Wash.

The Exchange Ice & Cold Storage Co., recently incorporated, Los Angeles, Calif., will build an ice-manufacturing plant.

The Coast Clay Co., Bellingham, Wash., is planning for the installation of new machinery at its plant. W. A. Doyle is manager.

The asphalt plant of Bryant & Austin, 1650 Compton Ave., Los Angeles, Calif., was destroyed by fire. The plant will be rebuilt.

The Crown-Columbia Pulp & Paper Co., Astoria, Ore., contemplates the erection of a new pulp-milling plant, near Svensen, Wash.

The San Francisco (Calif.) Power Co. plans for the construction of an electric-lighting and power system, at Livermore, Calif.

The Tulare (Calif.) Home Telephone Co. will make improvements and additions in its system. New equipment will be installed.

John Rowan, San Francisco, Calif., will soon commence the erection of an ice-cream manufacturing plant in San Luis Obispo, Calif.

The Dodson-Orr Realty Co., San Francisco, Calif., has purchased a new site near Herndon, Calif., and will install a pumping plant.

The Crescent Creamery Co., Los Angeles, Calif., has taken out a permit to make improvements and additions in its creamery plant.

The Globe Mining & Milling Co., Wenatchee, Wash., contemplates the erection of a plant for the reduction of quicksilver and similar products.

The Pomona (Calif.) Cannery Co. will increase the capacity of its canning plant. New machinery will be installed. G. H. Waters is manager.

The Froberg Aëroplane Co., Point Richmond, Calif., contemplates the erection of a plant, at Marysville, for the manufacture of aëroplanes.

The Tonopah Mining Co., Goldfield, Nev., plans for the erection of a hydro-electric-power plant on property recently acquired, near Lundy, Calif.

The Lobster Valley & Five Rivers Telephone Co., Denver, Ore., will make extensive improvements and additions in its telephone system and plant.

The St. Paul & Tacoma Lumber Co., Tacoma, Wash., will soon commence the erection of a large wood-creosoting plant. Geoffrey Winslow is manager.

The Peters Manufacturing Co., Portland, Ore., will build a large plant for

the manufacture of finished furniture products. A site has been acquired.

The rawhide goods manufacturing plant of J. D. Kelly, Aberdeen, Wash., was recently destroyed by fire. It is understood that the plant will be rebuilt.

G. E. Kingsley, Chamber of Commerce, Spokane, Wash., plans for the erection of a plant for the manufacture of potash products. About $500,000 is the estimated cost.

The Southern California Hardwood & Manufacturing Co., Los Angeles, Calif., contemplates making extensive improvements to its plant, at Eighth and Kohler Sts.

The H. W. Waite Lumber Co., St. Paul, Minn., has acquired the lumber plant of the Sobey Manufacturing Co., Granite Falls, Wash. It is understood that improvements will be made.

The Southwestern Sugar Co., Los Angeles, Calif., has acquired the sugar-manufacturing plant of the Corcoran (Calif.) Sugar Works. The capacity will be largely increased and new machinery installed. A plant for the manufacture of granite ware is contemplated in addition. W. D. Howarth is manager.

The Acme White Lead Co., Los Angeles, Calif., has acquired the paint-manufacturing plant of the H. R. Tibbetts Paint Co., Los Angeles. The capacity will be increased and new machinery installed.

CANADA

The Cosmos Cotton Co., Yarmouth, N. S., will double its factory capacity.

The Quaker Oats Co. will erect a factory in the vicinity of Winnipeg, Man.

The Montrose Paper Mills, Ltd., Thorold, Ont., will erect extensions to its mill.

The Canadian Mosiac Tile Co. will equip a new factory, at Vancouver, B. C.

James A. Goodwillie will build a large new fruit-canning factory, at Welland, Ont.

The Canadian Copper Co.'s hospital, at Copper Cliff, Ont., was destroyed by fire, at a loss of $40,000.

Carleton Place, Ont., will equip a new water-works system. Mayor Smythe has charge of the plans.

Kamloops, B. C., will expend $60,000 on improvements to its water-works system. J. J. Carment is city clerk.

Plans are being prepared for a factory to cost $35,000, for the Magnet Cream Separator Co., at Hamilton, Ont.

Belleville, Ont., will equip a new sewage system. The work will be in charge of City Engineer James Gray Lindsay.

The plant of the Dominion Vinegar Co., Hamilton, Ont., was destroyed. Complete new equipment will be purchased.

The Victoria Steam Laundry Co. will purchase the latest equipment for a big new steam laundry, to be located at Victoria, B. C.

Calgary, Alta., will expend $110,000 on the installation of a new filtration plant. City Engineer Childs will have charge of the work.

The sporting-goods firm of A. J. Reach & Co., Philadelphia, Penn., have purchased a site in Toronto, Can., where they will construct a plant.

The Chatham Gas & Electric Light Co., Chatham, Ont., will purchase gas engines, motors and other equipment for an addition to its power house.

The Toronto Suburban Railway, of Toronto, Ont., will build a number of new lines and will require additional power-house machinery and rolling stock.

The flour mills of J. W. Heney, Ethel, Ont., were completely destroyed by fire. Newer and larger mills with the latest machinery will be built as early in the spring as possible.

The biscuit factory of D. S. Perrin Co., Ltd., London, Ont., was burned, at a loss of $150,000. A new factory is to be erected to cost $200,000, and new machinery amounting to about $80,000 will be purchased.

British and Canadian capitalists have formed the Eastern Canada Power Co., capitalized at $100,000,000, to dam the St. Lawrence River, near Montreal, and develop 1,000,000 hp. Sir Max Aitken, a member of the British Parliament, is at the head of the company. The plan is to divert the St. Lawrence at the Coteau and Cedar Rapids and take the waterway about half a mile from its present course. It will mean building 25 or 30 miles of embankment.

FOREIGN

The Taku Harbor (Alaska) Canning & Cold Storage Co. plans to increase the capacity of its fish-canning plant.

The Mines Company of America, Madera, Chih., Mex., will soon commence the erection of a new electric-power plant.

The Nuestra Sonora Mine, Cosala, Sinaloa, Mex., plans to erect a hydro-electric power plant and the installation of electrical machinery.

Ed Hanley and F. H. Madden, Medford, Ore., will erect a new salmon-canning plant at Point Worde, Alaska. The estimated cost is $100,000.

The Seward Dredging Co., Nome, Alaska, plans for the erection of a 1000-hp. hydro-electric power plant, on the Solomon River. Otto Halla is head of the company.

The Bureau of Yards and Docks, Navy Department, Washington, D. C., will construct a sewer system, at the naval station, Hawaii. Bids will be received until 11 a.m., Mar.. 30, at Washington.

NEW INCORPORATIONS

METAL WORKING

The Grand Rapids Tool & Stamping Co., Grand Rapids, Mich., has been incorporated, with a capital of $25,000, for the manufacture of small tools and stampings.

The Pope Hartford Co., Chicago, Ill., has been incorporated, with a capital of $20,000, to manufacture automobiles. The incorporators are James Russell and Jessie Shields.

The American Speed Indicator Co., New London, Conn., has been incorporated with a capital of $50,000. The incorporators are: A. Mitchell, Jr., A. Hale and C. Kenney.

The Bath Garage Co., Bath, Maine, has been incorporated with a capital of $10,000 for the purpose of carrying on a general garage business. President and treasurer, C. W. Clifford.

The Portable Fire Escape & Manufacturing Co., of Cleveland, Ohio, has been incorporated, and will purchase equipment. Alden E. Overholser and J. J. Hartman are incorporators.

The Frost Engine Co., Evansville, Wis., has been incorporated, with a capital of $20,000. The incorporators are F. S. Frost, W. B. Meggott, C. J. Pearsall, W. H. Johnson and T. C. Richardson.

The Barnett & Hicks Co., Chicago, Ill., has been incorporated with a capital of $30,000, to manufacture rubber-stamp holders. The incorporators are G. W. Barnett, P. J. Hower and R. M. Royce.

The American Culvert Manufacturing Co., of Louisville, Ky., has been incorporated with a capital of $50,000 to manufacture materials for culverts. George W. Storms is one of the incorporators.

The Curtiss Motor Co., Hammondsport, N. Y., has been incorporated with a capital of $600,000 to manufacture motors, engines, etc. The incorporators are Monroe Wheeler, J. S. Fanciulli and G. R. Hall.

The Centaur Manufacturing Co., Buffalo, N. Y., has been incorporated with a capital of $35,000 to manufacture automobile appliances. The incorporators are: A. Schmidt, B. Schmidt and J. E Barry.

The Ventwell Store Front Co., Cleveland, Ohio, has been incorporated, and will equip a factory to manufacture metallic store fronts. The incorporators are A. Phillips, W. R. Phillips and J. Adams.

The Hagstedt Manufacturing Co., New York, N. Y., has been incorporated with a capital of $10,000 to manufacture machinery. The incorporators are Charles Hagstedt, Joseph Snyder and Ignatz Lauter.

The Warner File & Rasp Co., New York, N. Y., has been incorporated with a capital of $25,000 to manufacture files, hardware and machinery. The incorporators are J. Warner, C. B. Warner and J. C. Mitchell.

The Grace Machinery Co., of Burlington, Vt., has been incorporated. The company will manufacture the combined shear and punching machine invented by J. W. Grace, of Burlington, and A. J. Greig, of Barre.

The Brier Hill Steel Co., Youngstown, Ohio, has been incorporated with a capital of $15,000,000. It will erect open-hearth furnaces and finishing mills. The incorporators are H. H. Stambaugh, E. S. Ford and W. A. Thomas.

The Billstone Metallic Co., Findlay, Ohio, has been incorporated with a capital of $5000, to do a general machine and forging business. The incorporators are J. B. Askey, F. J. Sargent, F. R. Sheller, P. E. Hovis and H. P. Feree.

The Reynolds Manufacturing Co., Toledo, Ohio, has been incorporated with a capital of $50,000 to manufacture hardware. The incorporators are J. N. Reynolds, S. W. Reynolds, C. F. Reynolds, W. G. Nichols and R. Fitzpatrick.

The Bicknell Automobile Co., Bicknell, Ind., has been incorporated with a capital of $15,000, to do a general automobile business and will equip a garage and repair shop. The incorporators are E. T. Hollingsworth and J. E. Keith.

The Webb-Veitch Co., Jersey City, N. J., has been incorporated with a capital of $25,000 to manufacture automobiles, motorcycles and aëroplanes. The incorporators are Charles N. King, Jr., George H. Russell and Elmer H. Geran.

The Burk Kamra Co., Troy, N. Y., has been incorporated with a capital of $500,000 to manufacture moving-picture machines. The incorporators are James H. Caldwell, William Connors, J. H. Gleason, E. L. Grauel and Lewis Burk.

The F. B. Williams Co., Cincinnati, Ohio, has been incorporated with a capital of $10,000, to operate a repair shop and garage. The incorporators are S. D. Buchanan, Jr., George C. Kuhn, Dwight F. Jerauld, F. B. Williams and Samuel Hummel.

The Carroll Lock Co., Dayton, Ohio, has been incorporated with a capital of $50,000, to manufacture and sell locks and lock devices. Thomas Carroll, W. M. Carroll, Charles E. Carroll, George W. John and George V. Nauerth are the incorporators.

The Permanent Sales Co., Cleveland, Ohio, has been incorporated with a capital of $50,000 to manufacture cutlery, safes and suction cleaners. The incorporators are M. A. Limodge, James Pittaway, Fran Needham, D. E. Johnson and J. P. Wilsey.

The Knowlton Machine Co., Westbrook, Maine, has been incorporated with a capital of $10,000 for the purpose of manufacturing all kinds of machinery and engines. President, John D. Knowlton; treasurer, George H. Knowlton, Westbrook, Maine.

The Reynolds Manufacturing Co., of Toledo, Ohio, has been incorporated to do a general specialty manufacturing business, and will purchase machine-tool equipment. J. H. Reynolds, W. G. Nicholas and Robert Fitzpatrick are the principal stockholders.

The National Metalizing Co., Garwood, N. J., has been incorporated, with a capital of $250,000, to manufacture metals and metallic compounds. The incorporators are Royal W. France, Francis S. Viele, Carl J. Kulberg, J. P. Thorne and Leonard A. Watson.

The Cincinnati & Hammond Spring Co., Cincinnati, Ohio, has been incorporated with a capital of $50,000, to manufacture springs, axles and other parts of vehicles. E. V. Overman, W. P. Davis, J. B. Chilve, Edna Smith and Lyda A. Wescott are the incorporators.

The Seymour Auto Co., Seymour, Conn., was incorporated, Jan. 12, 1912, to make and deal in automobiles, etc. Capital, $10,000. The incorporators are: Ernest S. Clark, Beacon Falls, Conn., and Thomas S. Coleman and Edward F. Coleman, both of Seymour.

The Three-In-One Implement Co., Akron, Ohio, has been incorporated to manufacture and sell agricultural implements. Capital, $30,000. The incorporators are Jason S. Donnelly, Claude B. Carpenter, Walter E. Case, Martha E. Murphy and George W. Anton.

The Hoosier City Boiler Manufacturing Co., of Indianapolis, Ind., has been incorporated to manufacture boilers, tanks and general sheet-iron work, and will purchase punch presses, etc. James M. Broucher and J. I. Stephenson are the principal stockholders. Capital, $100,000.

The Ludwig Manufacturing Co., Sandusky, Ohio, has been incorporated with a capital of $10,000, to manufacture and sell general merchandise, including engine parts and machinery. Thomas J. Ludwig, Flora B. Ludwig, R. H. Shively, E. A. Sutton and Elizabeth Sutton are the incorporators.

The Pittsburg Saw Co., Pittsburg, Penn., has been incorporated with a capital of $10,000 for the purpose of manufacturing saws and saw machinery. The incorporators are F. E. Markell, Connellsville, Penn.; G. I. Falsom, J. C. Swearer and J. I. Heard, Pittsburg, Penn., and H. G. Young, Charleston, Va.

The Simplex Manufacturing Co., of Anderson, Ind., has been incorporated. The company is capitalized at $50,000, and will manufacture the Stanley self-starting attachment for automobiles. The officers are: President, W. R. Poland; vice-president, J. F. Stanley; treasurer, Guy J. Derthick; secretary, W. S. Poling.

GENERAL MANUFACTURING

The Joseph Cach Co., Cedar Rapids, Iowa, has been incorporated, with a capital of $15,000, to manufacture leather goods.

The Rose City Wood Distillation Co., Rose City, Mich., has been incorporated for the production of wood-distillate products.

The Fremont Corn Products Co., Fremont, Mich., has been incorporated, with a capital of $10,000, to manufacture products from corn for domestic use.

The Enameled Steel Brick Co., Detroit, Mich., has been incorporated, to manufacture a new style of brick. The principle stockholder is James Bennett.

The Troy Rubber Tire Co., Troy, Ohio, has been incorporated, with a capital of $10,000, to manufacture rubber tires for vehicles. J. Swiegart is an incorporator.

The C. F. Downey Box Co., Kansas City, Mo., has been incorporated, with a capital of $10,000. The incorporators are C. F. Downey, M. Downey and E. Downey.

The Englewood Distilled Water Ice Co., Englewood, Ill., has been incorporated with a capital of $100,000. The incorporators are J. B. Anderson and F. T. Anderson.

The Switz City Coöperative Telephone Co., Switz City, Ind., has been incorporated to erect and operate telephone lines. The principal stockholders are Henry Switz and D. J. Stantz.

The Barnaby Furniture Co., New York, N. Y., has been incorporated with a capital of $50,000 to manufacture furniture. The incorporators are J. Barnaby, C. C. Huyler and R. A. Rothwell.

The Alumina Oxide Manufacturing & Mining Co., Los Angeles, Calif., has been incorporated, with a capital of $200,000. The directors are Thomas Frey, William C. Marshall and Willis Marks.

The Choctaw Mill and Ginning Co., Bokoshe, Okla., has been incorporated, with a capital of $30,000. The incorporators are A. P. Gunther, F. T. Gunther, F. Beutelschies and C. Smith.

The Mitchell Parquet Floor Co., Brooklyn, N. Y., has been incorporated with a capital of $25,000 to manufacture flooring. The incorporators are P. S. Jones, V. C. King and C. W. Dunfee.

The Pioneer Iron & Steel Co., Sand Springs, Okla., has been incorporated, with a capital of $75,000. The incorporators are B. F. Rice, C. B. Farquarhson and J. H. Jenvins, of Gray, Ind.

The John A. Dunn Co., Boston, Mass., has been incorporated with a capital of $500,000 to manufacture and deal in chair furniture. John A. Dunn, president; Frank C. Dunn, treasurer.

The Acme Finishing Co., Pawtucket, R. I., has been incorporated with a capital of $225,000 to manufacture textiles. The incorporators are A. L. Lustib, H. C. Curtis and Adolph Gorman.

The W. Sallee Co., Indianapolis, Ind., has been incorporated, with a capital of $200,000. They will erect an artificial-ice plant. The incorporators are W. J. Sallee, F. C. Long and S. C. Brooks.

The Invincible Blow Pipe Co., Chicago, Ill., has been incorporated, to do a general manufacturing business. The incorporators are Otto Butzbach, John C. Zehfus and Andrew H. Anderson.

The William S. Hedges Co., New York, N. Y., has been incorporated with a capital of $200,000 to manufacture jewelry. The incorporators are Frank Jeanne, C. L. Roos and W. C. Gruner.

The Davis Boat Works Co., Sandusky, Ohio, has been incorporated with a capital of $15,000. The incorporators are A. B. Davis, S. C. Davis, K. L. Kelley, R. H. Williams and G. C. Steinemann.

The Great Western Cement, Sand & Stone Co., Esmond, Ill., has been incorporated, with a capital of $200,000. The incorporators are Wm. H. Ashelford, T. M. Clifford and P. Hyre, of Esmond, Ill.

The Casmire Manufacturing Co., Indianapolis, Ind., has been incorporated, with a capital of $100,000, to manufacture ice-cream freezers. The incorporators are B. A. Casmire, W. C. Bobbs, etc.

The Toledo Calendar Co., Toledo, Ohio, has been incorporated, to do a general printing and publishing business. They will need equipment. The incorporators are F. S. Popper and Charles Hartman.

The Ball Standard Cleaner Co., Chicago, Ill., has been incorporated, with a capital of $25,000, to manufacture ball standard cleaners. The incorporators are H. A. Fleck, F. Sack and A. Wicklund.

The Roth-Hamilton Manufacturing Co., Lafayette, Ind., has been incorporated, with a capital of $10,000, to manufacture steam engines. The incorporators are H. C. Roth, I. M. Hamilton and Deliah Roth.

The American Mailing System Co., Chicago, Ill., has been incorporated, with a capital of $20,000, to manufacture office and bank fixtures. The incorporators are Frank Pease and Vernon Loucka.

The Newark Art Foundry Co., Newark, N. J., has been incorporated with a capital of $10,000 to manufacture jewelry. The incorporators are Ernest Vatier, Louis Heck, William Arthur and James Metcalf.

The Younce Manufacturing Co., Union, Calif., has been incorporated, with a capital of $8000, to manufacture silos. The incorporators are D. S. Younce, E. Younce, S. Younce, D. Younce and J. Younce.

The Central Millworks Co., Chicago, Ill., has been incorporated, with a capital of $100,000, to manufacture millwork. The incorporators are S. B. King, F. Peska and Harry Harlbut, all of Chicago, Ill.

The Canara Paint Co., Cleveland, Ohio, has been incorporated with a capital of $5000 to manufacture paints. The incorporators are L. R. Canfield, G. A. Howell, Ralph Blue, A. J. Pearson and J. L. Bradley.

The Empire Case Goods Co. has been incorporated at Jamestown, N. Y., with a capital of $250,000, to manufacture furniture. The incorporators are F. O. Anderson, H. G. Anderson and A. Peters, of Jamestown.

The Berg Auto Trunk & Specialty Co., New York, N. Y., has been incorporated with a capital of $30,000 to manufacture automobile trunks and leather specialties. The incorporators are J. Berg, J. Baehr and J. T. Booth.

The Portable Fire Escape & Manufacturing Co., Cleveland, Ohio, has been incorporated, with a capital of $10,000. The incorporators are A. E. Overholzer, N. L. Overholzer, I. S. Overholzer, J. C. Spohn and J. T. Hartman.

The American Elastic Wheel Co., New York, N. Y., has been incorporated with a capital of $50,000 to manufacture automobile parts and accessories. The incorporators are Cesare Feroci, Frank Corsi and Frank P. Ward.

The Poland Street Ry. Co., Youngstown, Ohio, has been incorporated, to construct and operate an electric line. E. Mason Wick, Paul H. McElevey, W. Edgar Leedy, A. H. Rice and J. W. Blackburn are the incorporators.

The W. H. Miner Chocolate Co., Jersey City, N. J., has been incorporated with a capital of $500,000 to manufacture chocolate, cocoa and spices. The incorporators are H. T. Letts, C. A. Cole and Robert A. Van Voorhis.

The Citizens Ice & Bottling Co., Williamson, W. Va., has been incorporated with a capital of $20,000 to manufacture ice. The incorporators are M. H. Russell, J. A. Goodman, F. P. Jennings, M. F. Meek and James Damron.

The Muehlhauser-King Piano Co., Cleveland, Ohio, has been incorporated, with a capital of $10,000, to manufacture pianos. The incorporators are F. S. McGowan, E. A. Foote, A. R. Manning, Jr., L. M. Percival and S. Chestnutt.

The Fire Box Co., 1 Exchange Pl., Jersey City, N. J., has been incorporated with a capital of $60,000 for the purpose of manufacturing fire-extinguishing apparatus. The incorporators are V. Schmidt, E. Von Seyfried and W. E. Shultz.

The Steuber Brewing Co., Steubenville, Ohio, has been incorporated to engage in a general brewing business. Wilbert A. Meyer, John O. Bates, John Buehler, Charles F. Buehler and John L. Hellstern are the incorporators. Capital, $50,000.

The Yale Soap & Refining Co., Cincinnati, Ohio, has been incorporated with a capital of $100,000 to manufacture soap, etc. The incorporators are Charles J. Rentz, Bernard Peurrung, Otto Pfleger, Philip Renner and Roy Manogue.

The Buttler-Howell Co., New Brunswick, N. J., has been incorporated with a capital of $200,000 to manufacture sash, blinds, doors, stairs, cabinet mantels, etc. The incorporators are Howard V. Buttler, A. S. Howell, G. W. Buttler and Robert V. A. Buttler.

The Noequa Stone Tile Co., Jersey City, N. J., has been incorporated with a capital of $50,000 to manufacture artificial stone, ornamental tiling and wainscoting. The incorporators are Arthur F. Harroun, Frank D. Covey and Edward P. Storet.

The Mitchell-Conner Manufacturing Co., Cincinnati, Ohio, has been incorporated, with a capital of $25,000, to manufacture reversible windows and devices. M. A. Bear, Emil A. Hauck, John H. Ahlbrandt, Jr., Robert B. Rehm and E. B. Chrisholm are the incorporators.

The Sarco Engineering Co., Cold Springs, N. Y., has been incorporated with a capital of $100,000 for the purpose of manufacturing engineering and scientific intruments. The incorporators are A. Wiedenbash, C. W. Francis and H. M. Brighman, New York, N. Y.

The Michigan Office Appliance Co., of Detroit, Mich., has been incorporated, to manufacture office appliances and supplies, such as card files, bookcases, index cabinets, desk fittings, etc. B. M. Cary, 200 Lincoln Ave., Detroit, and Harvey S. Willson, 207 Sun Building, Detroit, are the stockholders. Capital, $10,000.

The Pan-American Match Co., North Baltimore, Md., has been incorporated to manufacture matches. James F. Klotz, Clara H. Wideman, Robert T. Morrison, Samuel Cunningham and F. P. Wideman are the incorporators. Capital, $75,000. The company is a reorganization of the Buckeye Match Co., of North Baltimore.

Business Items

Firth-Sterling Steel Co. has opened a branch at Sixteenth and Connecticut Sts., San Francisco. E. O. Reynolds, manager.

Announcement is made of the reorganization of Watson-Stillman Co., manufacturers of hydraulic machinery, with a plant at Aldine, N. J., and general offices at 50 Church St., New York. The growth of the business necessitates an immediate extension of the company's manufacturing facilities. The new officers elected are: Francis H. Stillman, president (reëlected); E. A. Stillman, vice-president; J. P. Bird, treasurer; A. F. Stillman, secretary and works manager, and Carl Wigtel, chief engineer.

Forthcoming Meetings

American Society of Engineer Draftsmen. Regular Meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Hotel Bellevue. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month, Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Canada

STORES-MAN, thorough, uptodate, energetic stores-man; one who has had a large experience in looking after materials, rather than ordering of materials; one familiar with perpetual or latest inventory systems; electrical trade preferred; good salary paid to competent man. Reply, with references, to Canadian General Electric Co., Peterboro, Ont.

Maryland

SPOON MAKER—Must be experienced and familiar with uptodate methods of making retinned steel spoons, knives and forks; good opportunity for right man; give references. Address "Expert," Am. Machinist.

Massachusetts

DESIGNER on special automatic machinery; permanent position; require speed, accuracy and ideas; state age, references and salary. Box 892, Am. Mach.

SUPERINTENDENT to take charge of plant manufacturing small tools, such as cutters and drills; good opening for a man of experience and executive ability; liberal salary. Box 870, Am. Machinist.

MAN competent to run a 48x48x12-ft. Cincinnati planer on machine-tool work; also man to run 24-in. Bullard vertical turret lathe; in replying, state age, nationality, experience, places and periods of employment and salary expected. Box 809, Am. Machinist.

INDUSTRIAL ACCOUNTANT — Efficiency engineer; we wish to secure the services of a competent accountant who is prepared by sound training and successful experience to take responsible charge of the organization of factory accounting systems, scientific planning of factory work and improvement in methods to secure increased production efficiency. Our requirements are emphatically for an accountant, but we prefer a man who is also a technical graduate. We should be especially interested to hear from a man who has had marked success in constructive accounting for industrial plants or other enterprises. We are prepared to make the position attractive in respect to present salary and opportunity for the future. Application should be as complete as possible stating age, nationality, whether married or single, and giving specific details of education and experience. Clinton H. Scovell & Co., Certified Public Accountants Industrial Egineers, 40 Central St., Boston.

Michigan

OPERATORS—We are frequently needing good operators for turrets and gear cutters, principally Jones & Lamson and Gleason, and invite applications. Frost Gear & Machine Co., Jackson, Mich.

DRAFTSMAN—One who has had experience in mixing and agitating machines, also conveying and flour mill machinery; state experience and wages expected. Box 861, Am. Machinist.

A LARGE manufacturing concern offers exceptional opportunity and chance for advancement to young men who are good mechanics; if you are thoroughly experienced, ambitious, a hustler, of good character, and have ability to direct others to increased efficiency, Box 896, Am. Machinist.

Minnesota

DESIGNER and draftsman who is thoroughly familiar with the design and manufacture of folding film cameras; write in confidence, giving full particulars as to experience, age and salary expected. Box 831, Am. Machinist.

New Jersey

HARDENER — Working foreman to take full charge of hardening department; must be familiar with tool steel and case hardening of low carbon steel. Address Kraeuter & Co., 585 18th Ave., Newark, N. J.

ELECTRICAL INSTRUMENT MAKERS —Several, first class, for our experimental department. Call or communicate with Mr. E. F. Harder, Manager Newark Works, Westinghouse Electric & Mfg. Co., Newark, N. J.

New York

TOOL DRAFTSMAN, experienced, for small electrical work. Adddress P. O. Box 794, Rochester, N. Y.

SALESMAN to sell lubricating and cutting oils; A-1 man wanted. Save Oil Co., 32 Union Square, New York City.

FOREMAN—For small general jobbing machine shop employing from fifteen to twenty men, on light and heavy work; must be a man of wide experience, able to handle men and familiar with modern methods, location, northern New York State. Box 893, Am. Mach.

SUPERINTENDENT, pump shop, western New York, employing 200 men; modern shop; growing business; want a capable, experienced, practical manager, who can manage successfully from raw material to finished product and show results; exceptional opportunity for returns and development; young man. Box 881, Am. Machinist.

Ohio

DESIGNER—A first-class printing-press designer; a responsible and well established company, who are developing a rotary press, wants to secure a press designer who has had a broad experience in this line; the right man can command a good salary and secure a stock interest in the company; all correspondence strictly confidential. Address "Rotary Press Builder," Box 867, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal pattern-makers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

TOOL MAKERS—Several first-class tool makers, experienced on small, accurate die work; state experience and salary wanted. Box 811, Am. Machinist.

INSTRUMENT MAKERS, familiar with the electrical appliances; communicate with the employment department, Westinghouse Electric & Mfg. Co., East Pitsburg, Penn.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Rhode Island

FOREMAN—For small cold punched nut department; must be acquainted with automatic devices, or have brains to originate them. Box 829, Am. Mach.

FOREMAN—Capable, energetic, young man of small hand screw machine department; must have general knowledge of setting of tools, and good ideas as to best methods of manufacture. Box 828, Am. Machinist.

POSITIONS WANTED

Connecticut

MASTER MECHANIC — Experienced technical man wishes a position in the East as master mechanic or chief draftsman; have had 14 years' experience designing heavy, light and automatic machinery. Box 894, Am. Machinist.

FACTORY MANAGER or superintendent; connected with one of the most progressive concerns of the country, desires a change; broad experience with successful corporations in varied lines of product; thorough mechanic, systematizer and executive. Box 834, Am. Mach.

Illinois

SUPERINTENDENT—I desire a change; have had twenty years' factory experience, ten as superintendent; also inventor and designer. Box 909, Am. Ma.

Massachusetts

AMERICAN, inventor and practical mechanic, experienced as foreman, superintendent, chief designer on jigs, all kinds of dies, complicated and special machinery, desires responsible position. Box 900, Am. Machinist.

Michigan

TOOL ROOM FOREMAN, practical, A-1 tool maker, past five years as foreman and general foreman; experienced on drill, jig, fixtures, gages, punches and dies, general tools to produce interchangeable parts and manufacturing; can handle men; guarantee best results. Box 895, Am. Machinist.

Missouri

SUPERINTENDENT or assistant; wide shop experience; write for particulars. Box 850, Am. Machinist.

SALESMAN, machine tool, wishes to change, responsible position, such as sales manager or buyer; 11 years' practical experience, five years on road for leading manufacturers; good correspondent; references. Box 849, Am. Ma.

New Jersey

DRAFTSMAN, experienced on automatic machine tools and automobile work, desires position. Box 899, Am. Ma.

FOREMAN—Practical, general shop experience, ten years executive, 25 to 100 men, desires change. Box 907, Am. Machinist.

DRAFTSMAN, experienced in checking, machine shop, tool room, instrument and vacuum cleaner work; also interchangeable tools. Box 910, Am. Mach.

MECHANICAL DRAFTSMAN, graduate, three years' experience; can make good where speed can be used to advantage. Box 898, Am. Machinist.

MECHANICAL ENGINEER, designer, experiments, improvements on product or production methods and equipment; ten years each, practical and engineering experience. Box 913, Am. Machinist.

New York

MECHANICAL DRAFTSMAN, various experience, wishes to change. Box 872, Am. Machinist.

SUPERINTENDENT or manager with large concern by an uptodate live man. Box 837, Am. Machinist.

DESIGNER, experienced in designing special and automatic machinery, wants position. Box 483, Am. Machinist.

DRAFTSMAN, two years' experience on automobile work, detailing and tracing; age 23. Box 901, Am. Machinist.

DRAFTSMAN, special automatic machinery, desires position; nine years' experience. Box 906, Am. Machinist.

FACTORY ENGINEER, high-grade mechanic, expert in tool design, cost reduction and increase of output, desires position. Box 908, Am. Machinist.

DRAFTSMAN, experienced designer on light and special machinery; good original ideas, fast and accurate; good references. Box 902, Am. Machinist.

DRAFTSMAN, five years' successful designing experience, four years' shop experience; can make good with reliable concern. Box 903, Am. Machinist.

OXYACETYLENE welding and cutting; experienced German brings his own apparatus; repair work all kinds. "Schneider," 2128 Caton Ave., Flatbush, N. Y.

DESIGNING DRAFTSMAN is open for employment; experience Corliss steam engines, air compressor, rock drills, tools and fixtures; capable and ambitious; can furnish A-1 references. Box 911, Am. Machinist.

SUPERINTENDENT—Open for engagement at once; well advanced in scientific management, time study and differential bonus systems; been exceptionally successful in past; salary to start, $2400 per year. Box 836, Am. Machinist.

Pennsylvania

MANAGER—By technical graduate; twelve years' experience; steel foundry and general machinery business. Box 912, Am. Machinist.

Wisconsin

GENERAL FOREMAN or factory superintendent, experienced on steam and gas engines, heavy and medium mill machinery and pneumatic tools; open for engagement at once; best of references. Box 876, Am. Machinist.

DESIGNING ENGINEER, graduate, 15 years' practice, age 35; an expert on experimental design and development of medium weight automatic and fine machinery; successful now in charge designing entirely new line automatic machines; always produce good results and need not make excuses. Box 871, Am. Machinist.

MISCELLANEOUS

Test indicators. H. A. Lowe, Cleveland, O.

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Technical Patents. G. M. Sacerdote, M. E. and P. A., 1919 Broadway, New York.

Broken machinery welded and guaranteed. Waterbury Welding Co., East Waterbury, Conn.

For Sale—One new 300-ton electrically tilted hot metal mixer of latest design. Box 897, Am. Machinist.

High-grade machine work in quantities for gear cutters, hand turrets, milling machines, etc., wanted. The Seneca Falls Mfg. Co., Seneca Falls, N. Y

Tool tempering chart, 13½x1½ inches, printed in colors with full description; 10 cents postpaid. Spon & Chamberlain, 123 Liberty St., New York, publishers.

Special machinery. We have the best facilities for building to order medium weight, high-grade machinery. Thirty minutes from Broadway. The Binsse Machine Co., Harrison, N. J.

Finest work at minimum cost on all kinds of dies, jigs, tools, brass patterns and experimental work; we will manufacture any sheet-metal article, write us. Nelson & Moon, Buckeye & 11th Sts., Terre Haute, Ind.

Wanted—Estimates to furnish on yearly contract printing machines weighing 5000 lb. each; examination of machine and full information furnished to competent and reliable concerns only. "Automatic," Am. Machinist.

Hungary. A Budapest firm of high standing wants agencies in Hungary for a few first-class American tools. There is business here for you if you coöperate with us to get it; references exchanged. Box 512, Am. Machinist.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

A real live firm of engineering contractors, doing fine business with consulting engineers, industrial concerns and the building trade throughout England, are prepared to represent an American house of good financial standing. Reply Box No. 1173, care of C. Mitchell & Co., Ltd., 1 and 2 Snow Hill, London, E. C.

Alfred Herbert, Ltd., small tool department, Coventry, having an extensive organization and a large staff of salesmen specially engaged on small tools in Great Britain, France, Switzerland, Japan and Italy are open to handle good agencies for small tools of all kinds, and invite correspondence with manufacturers.

Talks With Our Readers

By The Sales Manager

In a large corporation composed of several subsidiary machinery-building concerns, the General Manager had suddenly resigned, and his place was taken by an official of one of the affiliated companies.

The new executive manifested an immediate interest in the details of the work.

The cost system was among the first of these details to enlist his attention. It proved to be very elaborate—unnecessarily so to his mind; but he made no adverse comment at the time.

"Seems to be very complete," he remarked.

"Yes," replied the Works Manager, "we aim to keep a close, careful record of our shop expense."

"Let's take a walk through the plant," proposed the General Manager.

As they passed along the pattern-making department he observed a group of saw tables which had a somewhat unfinished appearance. "Hello," he ejaculated, "Where did you get those tools?"

"Why," answered the department foreman who had fallen into step with them, beaming with pleasure at the attention, "we made them ourselves and saved considerable money. They are only for very simple operations, and there was no need of paying what the regular machines would cost."

"I see," said the General Manager, "Do you use them much?"

"Well, no, not since we got the new self-feed machines over there, but they come in handy for certain work."

In the foundry the superintendent of that branch of the work joined them, explaining with much zeal the methods used there. It was evident at a glance that the traditional backwardness of the foundry didn't apply in this plant. All work was in orderly progress, the aisles were clear and there was abundant labor-saving equipment.

"You seem to have spent a lot of money on equipment," remarked the General Manager. "Couldn't you have made some of these rigs yourself; those pillar cranes or the riddles, for example?"

"We could, yes, sir," was the response, "but the people who specialize in each of these lines can sell the apparatus at a good deal less than we would be able to turn it out for, and it's a great deal more efficient. You would be surprised, if you haven't been brought up in foundry work, to know what a difference there is in equipment for even the simplest, roughest kind of work and what a saving in the men's time there is with rigs made especially for it. Our cost sheets will show, sir, that since the improvement we made here last year in our mechanical equipment we have cut running expenses over 20%."

"That's the talk," said the General Manager. "Cut 'em some more," and he walked on into the first machine shop. There he was rejoined by the Works Manager, who had been called on ahead and did not hear the conversation just recorded.

"Here, Mr. Caswell," said the latter, "I want you to look at these special boring machines, drills and grinders built on our own designs, and at the shapers, slotters and keyseaters on the other side. We can do all kinds of stunts with them.

"Were they made here in our own plant?" asked the General Manager.

"Yes," was the reply.

"What was the idea? Couldn't you get tools for the work?"

"I presume we could; but what we needed was tools for certain special operations occurring over and over; and we didn't have to go to the expense of getting standard machines with all the extra parts and attachments which they put on them for all kinds of service."

"Seems to me,' said the General Manager, "that I've seen special grinders like these advertised for just the sort of work they're doing now; and you'll find slotters and key-seaters like the ones you have here, in the Niles catalog for some years back. I'm not sure about the shapers, but I believe you can get them for just that class of work."

"Maybe you're right," agreed the Works Manager, somewhat nettled at this mild criticism where he had looked for credit, "but they would certainly have charged us more for them than it cost to put them together here, and we were sure that we were getting tools just suited to our operations."

The next day, however, the General Manager had a list prepared of all the machinery built by the company for its own use. Then he called for the man in charge of the cost system.

"Give me the complete cost on these machines," he said; "from the way you keep your records, as you showed them to me yesterday, I presume it will be a simple matter to pick out the figures."

When the full report, which the harassed clerk had been asked for several times, was finally handed in, it uncovered a "mare's nest" that made the General Manager gasp. Not only had each machine cost an excessive price, but the orders on which the tools were built had had charged against them all manner of inconvenient items which must be disposed of somehow at the various times so as not to get the responsible employees into trouble. Breakage, spoilage and errors of all kinds, absences unreported, jobs done privately for someone in authority and all the flotsam of a large plant had apparently contributed to the grand total. Moreover, a supplementary shop report and comparison with records obtained elsewhere showed that the average operation on the home-made tool required longer than similar work done on a machine built by specialists in that line. Estimating the net losses occasioned by their relative inefficiency during the periods they had been in service, the balance against them was so huge as to be unbelievable.

The General Manager had this all put in graphic form. Then he sent it to the Works Manager. And the Works Manager saw a light.

* * *

Only reliable products can be continously advertised.

The Panama Canal Shops at Balboa

By Fred H. Colvin

The shops at each end of the canal take care of the repairs on the drill barge dredges and other marine equipment. The largest of these is at Balboa (which was formerly called La Boca) at the Pacific end of the canal and is shown herewith. The other at Cristobal is smaller although it has a small drydock.

Much interesting French equipment is to be found at Balboa, both in the shape of machine tools and in engines and boilers. The French bought enormous quantities of spare parts which we are still using to good advantage.

The shops at Balboa are used to keep the dredges on the Pacific end of the Panama Canal at work and are about two miles from Panama City. They were built by the French and are much the same as when they left them except as to equipment.

A good general idea of the shops, their surroundings and the Pacific end of the Canal, may be had from Fig. 1. The straight channel is the new canal, which is nearly finished at this point, while the curved channel at the right is the old French route. The shipways and repair shop are at the left, while the machine shop is at the extreme right. In front of these, by the bend in the French channel, are the sand-storage bins and to the left of these the engineers office, as shown in more detail in Fig. 16.

The machine shop is of steel construction, as can be seen from the illustration, Fig. 2. It was provided with a crane, the runways supported on the brackets of the columns. The crane was originally hand operated but electric motors were secured after much difficulty and the crane is now about as convenient as they make them, being well suited to the work it has to do. Many of the tools are also remnants of the French days but are doing good work in keeping the dredges at their task of cutting out the channel below the Miraflores locks. Although the rock beneath the water is broken up either by the Labritz breakers, which drop a sharp steel point backed by a 19-ton ram, or by drilling and blasting, the dredge buckets receive very severe treatment at times, as can be seen from Fig. 3. These are frequently cracked, rivets sheared off and the sheets torn, while complete destruction occasionally occurs as shown. The general arrangement of tools in the shop is shown in Fig. 2, most of the heavy machines being on one side of the crane runway so that they can be served by it. The main space under the crane is reserved for erection purposes.

French Machines

One of the old machines left by the French was the gap lathe shown in Fig. 4. This was made by Vanday & Mailliard, Luco & Cie. and brought over from France in the early days. Most of the other machines are modern and of American make, although there are a quite a few French drillers, as can be seen from Fig. 5. In the background of this view is one of a type of French stationary engine, which seems to have been quite a favorite, and specimens of which were found in nearly every shop. According to some of the engineers this engine is about the only piece of machinery in the shops that was neither well designed nor well made and that did not stand up to the work. This is probably because this type was built for lower steam pressures and not intended for the work we expect from an engine of such size.

In the boiler house, which adjoins the shop, is a battery of French boilers, two being shown in Fig. 6. The peculiarity

Fig. 1. The Balboa Marine Shops at the Pacific End of the Panama Canal

of these boilers is that the flues are all fastened to the head shown. By removing the numerous nuts and bolts shown around the flange, the whole head comes off and brings all the tubes with it, for inspection or repair.

The Work Done

The work done here probably resembles the average repairing shipyard more closely than anything else; one of the jobs being shown in Fig. 7. This is a tail or propeller shaft being fitted up for one of the tugs or "clappets" as the dumping, sea-going steam barges are called. Near this is a coldsaw, mounted and driven as shown in Fig. 8, and very useful in all kinds of work. The mounting and driving are a trifle unusual.

One of the relics of the French is the improvised vise or clamping stand shown in Fig. 9. Although no one seems to have discovered just what it was for, it was probably devised to handle some special job which came along more frequently than some of the others.

Just to get an idea of the size of one of the upper gear drives on the ladder dredging boats, compare its size with that of a man of more than average height. The gear drive, which consists of the square sprocket or carrier for the buckets of the dredge, and which carry them and their load up to the point where they discharge, makes large work to handle in a small shop, but they manage to do it very creditably. These are shown in Fig. 10.

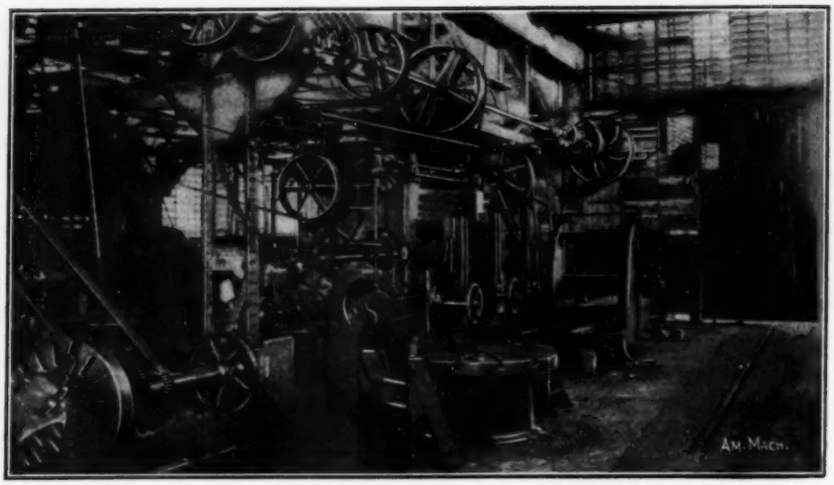


Fig. 2. The Machine Shop Built by the French

Rebuilding a French Steam Launch

One of the interesting stories of the way in which old French material was found and utilized, is in connection with the steam launch "Birdena" in which James Macfarlane, the superintendent of dredges at Balboa, took me over the Pacific end of the Canal and as near the first locks on that side, at Miraflores, as possible. The "Birdena," as she is now called (and the naming of it makes another story), was found high and dry in the Culebra cut with her hull cut into two, in as rough a manner as possible by cold chisel and hammer.

According to the story she had been brought over in sections and put together on a little artificial lake which had been formed by directing some stray streams into a suitable depression. This was at the time when money from the early subscriptions was running low and more had to be secured to keep things moving. A few photographs showing the Atlantic and Pacific ends of the canal, and a real

Fig. 3. Dredge Buckets which Have Seen Hard Service

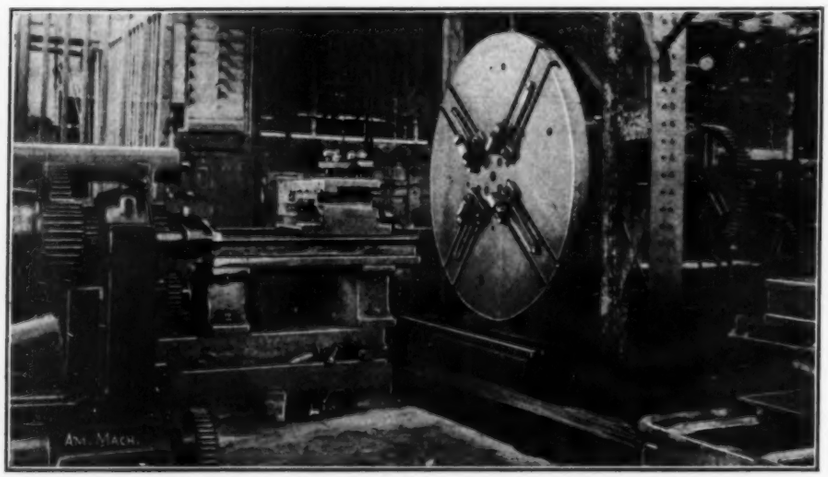


Fig. 4. A Large French Lathe

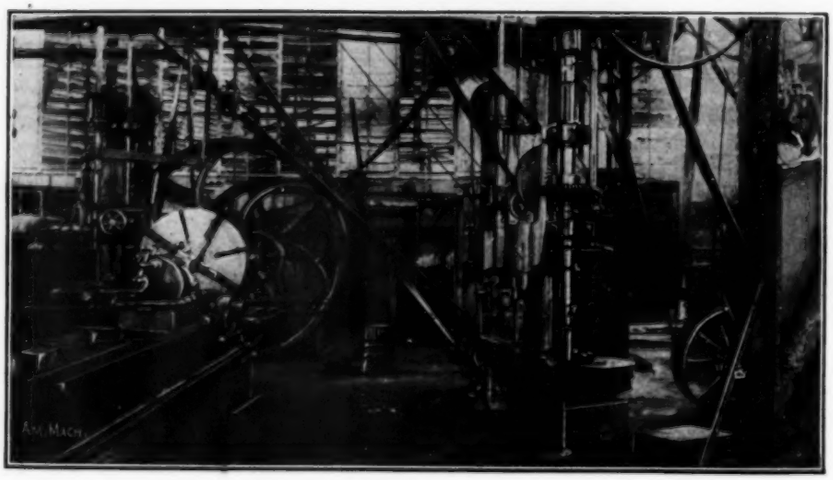


Fig. 5. French Engine and Drillers

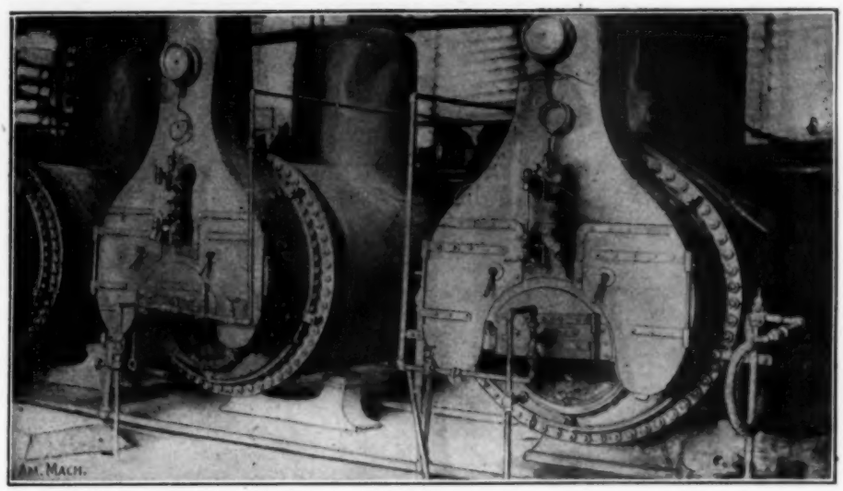


FIG. 6. PART OF A BATTERY OF FRENCH BOILERS

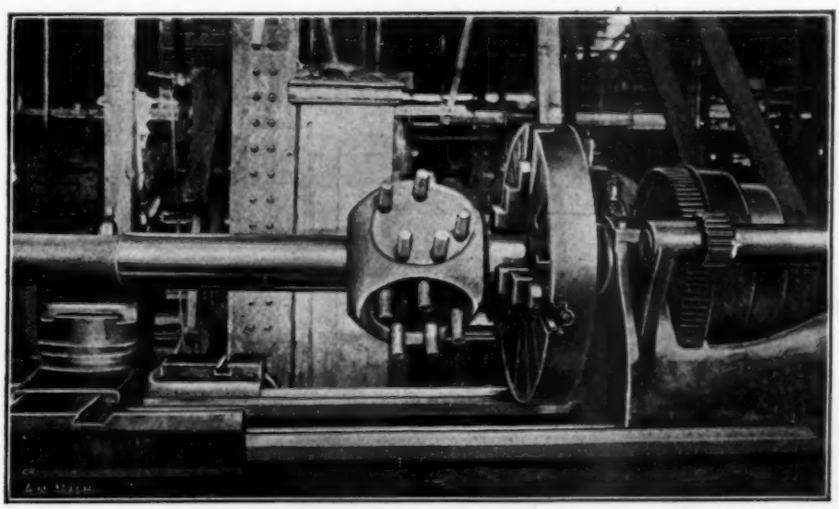


FIG. 7. REPAIRING A TAILSHAFT

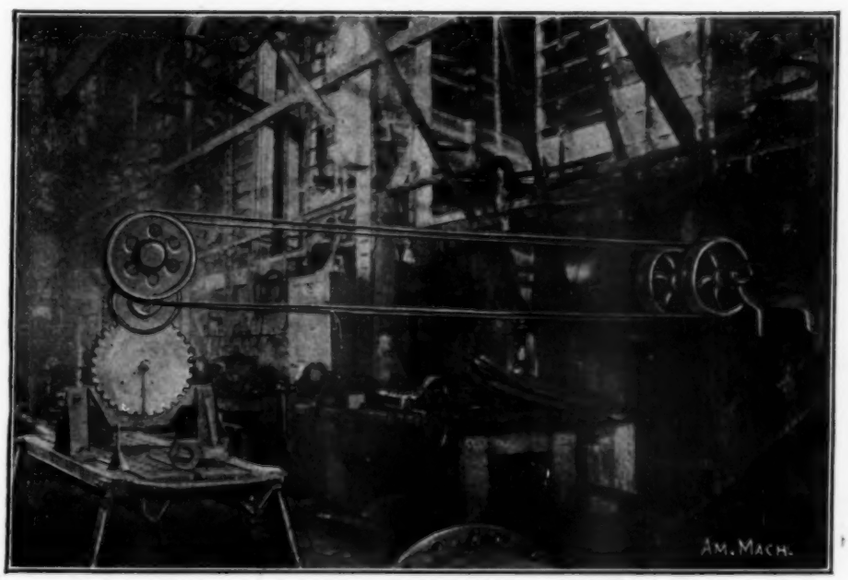


FIG. 8. COLD SAW AND DRIVE

boat on real water near the middle, helped wonderfully in raising more of the needful cash.

It is easy to condemn the officers of the French company for using such methods and yet it must be remembered that such an enterprise always requires more money than anticipated, even without graft, and that, by the terms of the

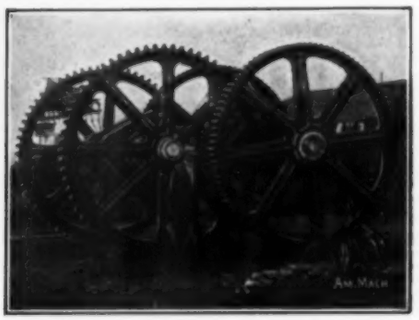


FIG. 10. UPPER GEARS FOR BUCKET OF LADDER DREDGES

concession the work had to go on without interruption. In fact it never did stop entirely as some men were still there when it was turned over to our Government.

The "Birdena" was loaded on flat cars and taken to the shops at Balboa, which also has a shipway, and was there rebuilt, as can be seen from Figs. 11 and 12, which were kindly furnished by Mr.

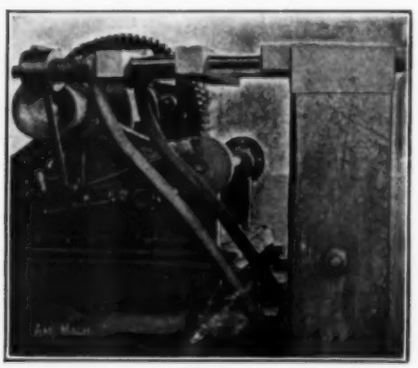


FIG. 9. SPECIAL VISE, A RELIC OF THE FRENCH

Macfarlane. He, by the way, antedates the American work on the Canal, having been with the Panama Railroad in the old days and living on the Isthmus about 11 years. This means that he has been through several revolutions and seen all phases of the work.

CHANGING THE NAME

When the boat was found it was named "Culebra" and so it remained until one day along in the Wallace regime on the Isthmus. Hurry orders were received one afternoon to change the name to "Birdena" before morning and it was done with great hustling. No one knew the whys or wherefores until the next

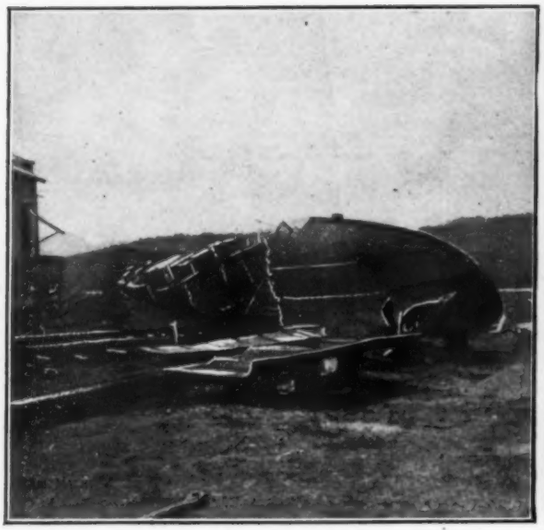


FIG. 11. THE "BIRDENA" AT BALBOA BEFORE REBUILDING

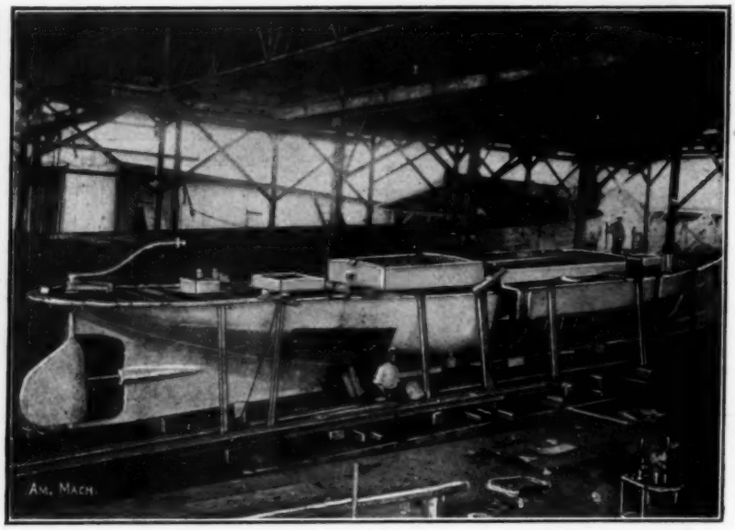


FIG. 12. THE "BIRDENA" IN THE WAYS IN THE COURSE OF REBUILDING

morning, when Miss Birdena Wallace appeared on the scene and was surprised and delighted to find her name on such a fine launch, and the mystery was explained. It is quite probable that the cost of this went in the general expense account.

PORTABLE BOILER PLANT

Another way in which the French material is utilized is shown in Fig. 13, where one of the old saddle-tank locomotives is being used to supply steam for the pump and other machinery used in preparing for the new large docks which are to be built at the Balboa end of the Canal. As will be seen, the engine has been stripped of side rods and is being used simply as a stationary boiler, a temporary coal bin having been built convenient for the fireman. In the background is the overhead work of the sand-storage bins which are used in handling the sand used for the concrete at this end of the Canal.

OIL AS FUEL

Oil is used very extensively for fuel on the Canal zone, beginning with the passenger locomotives of the Panama Railroad and going down to the smallest furnaces in many cases. Fig. 14 shows a large oil furnace which is used for annealing and for heating the large plates and long bars which are used at Balboa, in connection with the repair of dredges and other equipment. This furnace is perhaps 18 ft. long and at the further end, which could not be shown, is a long iron table for handling the work both before and after being heated.

A distributing head for air pressure is shown in Fig. 15. This is found very convenient in work of this kind, as it allows a number of different applications of air to be made with only one pipe

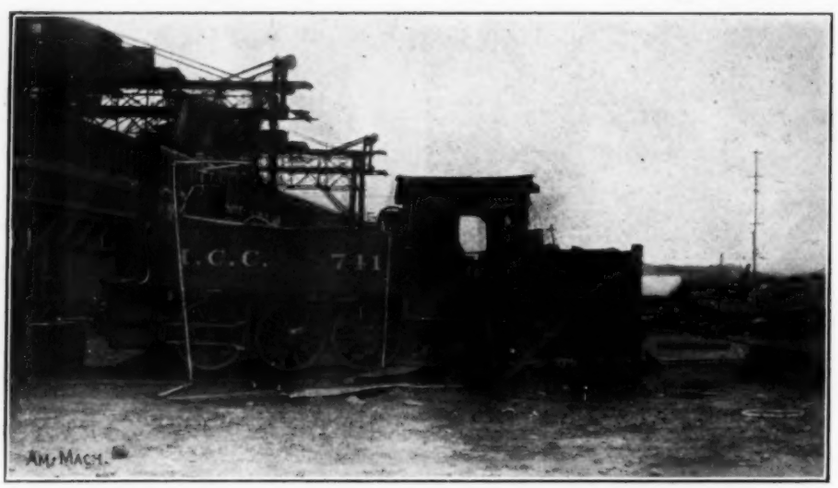


FIG. 13. OLD LOCOMOTIVE AS STATIONARY BOILER PLANT

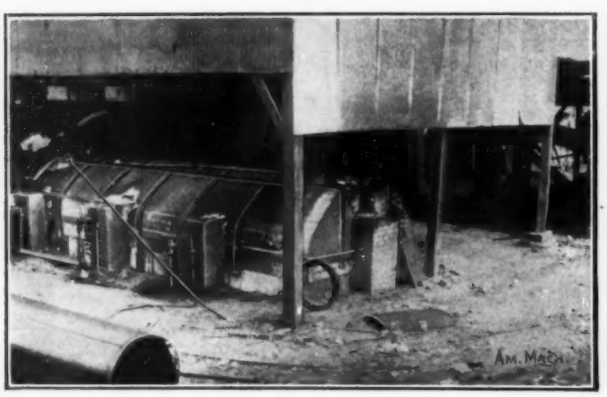


FIG. 14. LARGE ANNEALING FURNACE USING FUEL OIL

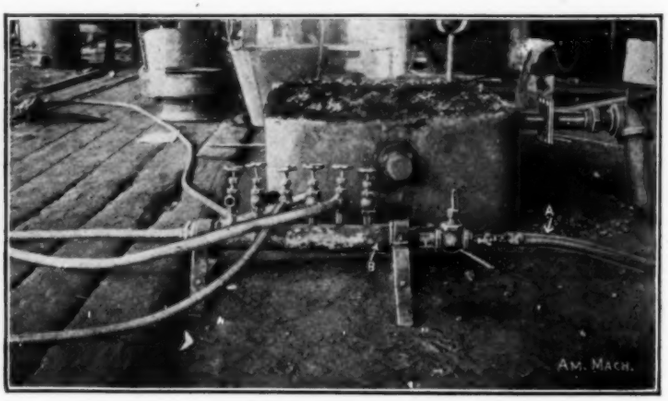


FIG. 15. DISTRIBUTING HEAD FOR AIR PRESSURE

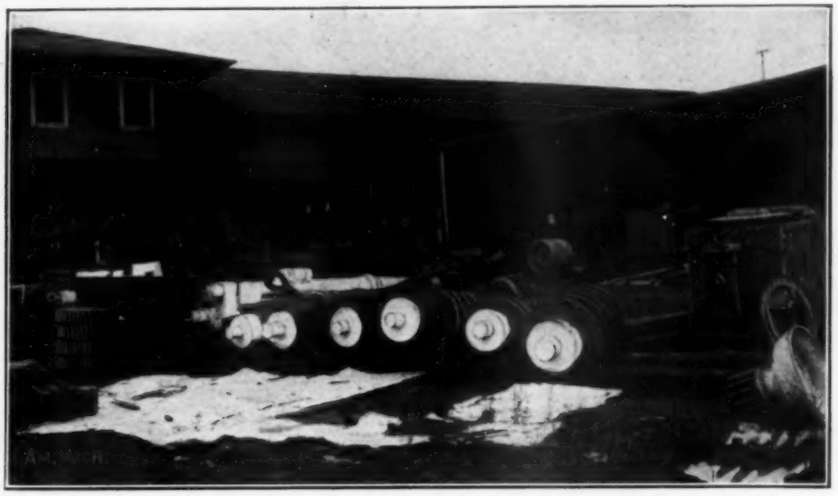


FIG. 16. SPACE PARTS FOR THE FRENCH DREDGES

line running from the compressor or the reservoir. Air comes from the pumps through the hose *A* at the right, and into the distributing head *B*, from which it can be taken off in any one of six different directions, each controlled by the small globe valve shown. The air taken off in this way is used either in connection with pneumatic tools, or for supplying the blast of oil-fed furnaces which are largely used in heating rivets and in similar work in various parts of the plant.

It will be remembered that the work at Balboa is practically shipbuilding and repairing, and that it has a much greater variety than is found in the usual shop. Dredges are rebuilt, "clappets" come here for repairs, as do steam barges, rock breakers and submarine rock drills for use in blasting out the bottom of the canal channel. All depend on Balboa to keep them in condition for as nearly continuous service as can be obtained.

One of the main requirements for keeping the dredges at work is that there shall be plenty of repair parts on hand, so that there need be no delay when breakage occurs, as it very often does. The French evidently recognized this, as can be seen from the material shown in Fig. 16, largely a remnant of the French days. As will be seen, this includes gear wheels, winding shafts, engine cylinders at the right, and even complete engines in the center background. These have been found extremely useful

FIG. 17. TWO VIEWS OF A METHOD OF BUILDING A CONCRETE BARGE

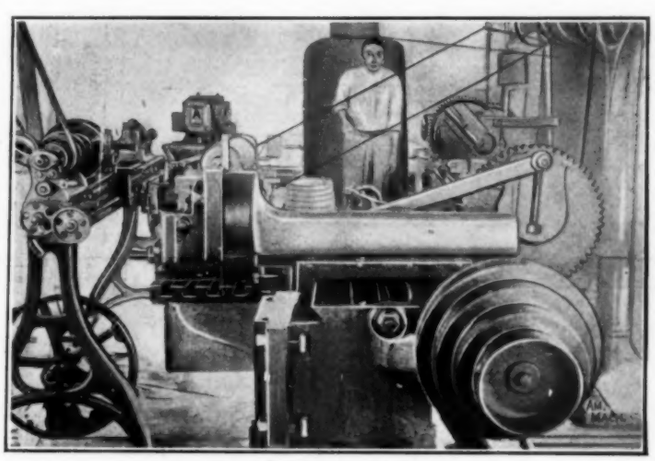


FIG. 18. POWER END OF FLOATING SHOP

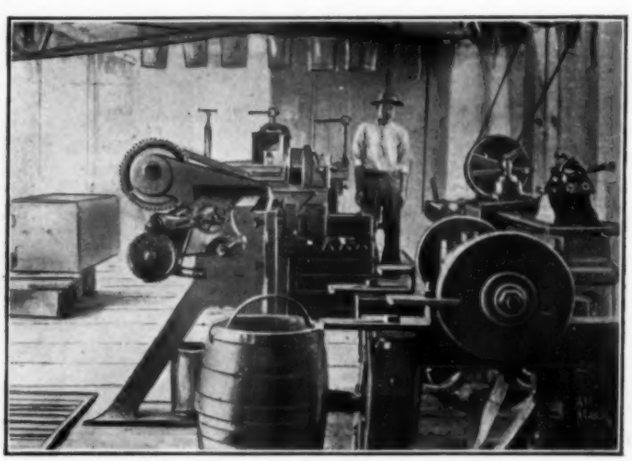


FIG. 19. OTHER END OF SHOP

and have enabled the dredger to be kept at work much more continuously than would have been otherwise possible, particularly when it is remembered that nearly all of these were of foreign manufacture.

Buildings in Tropical Countries

An inspection of the construction of the building in the background will give an idea of a method largely followed in tropical countries, either on first- or second-story work. As will be seen, the

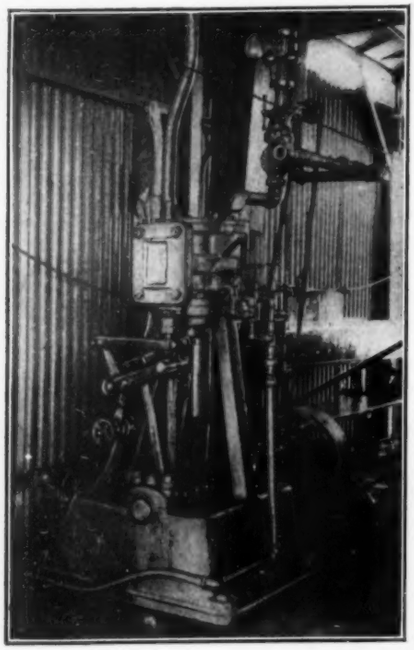


Fig. 20. French Engine Driving Shop

roof projects for a considerable distance over the side wall, and under this the building is open for several feet down to a side wall, perhaps four or five feet from the floor.

When considered necessary, the open space is covered with a wire netting of whatever mesh and strength may be considered necessary to protect the contents against intruders of any kind. In many cases, nothing whatever is used. This open side supplies light and also allows excellent ventilation, and, even on the hottest days, there is usually a fair breeze, which makes many of the shops fully as comfortable as some in more northern latitudes. In fact in some cases, difficulty was experienced in keeping the camera steady on account of the breeze which seems to be always present and which plays havoc with a camera on a light tripod.

Building Concrete Barges

There was considerable talk some time ago about the concrete barges which were built at Balboa, to be used simply as pump platforms in the under-water portions of the Canal. They were not built simply on account of extreme novelty, but because with the conditions existing at that time, they could be built more easily and quickly than if either wood or steel had been used. Concrete is very cheap at Balboa, owing to the presence of both sand and rock in the vicinity, and by the use of wire netting as reinforcement, it was possible to build these for less cost and in less time than in any other way. Fig. 17 gives an idea of the way in which they were built up.

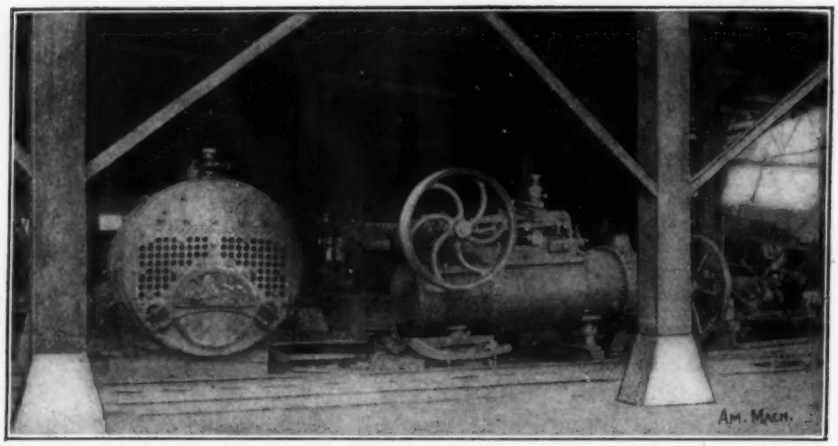


Fig. 21. French Boilers and Engine

The adverse criticism which has been made of these barges has, as is often the case, come from the fact that they were used quite differently from what was originally intended. Instead of be-

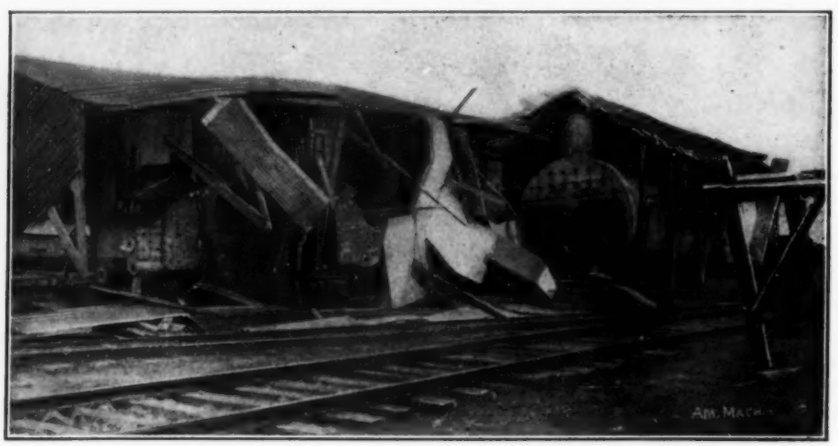


Fig. 22. Using Parts of a Dredge for Repair

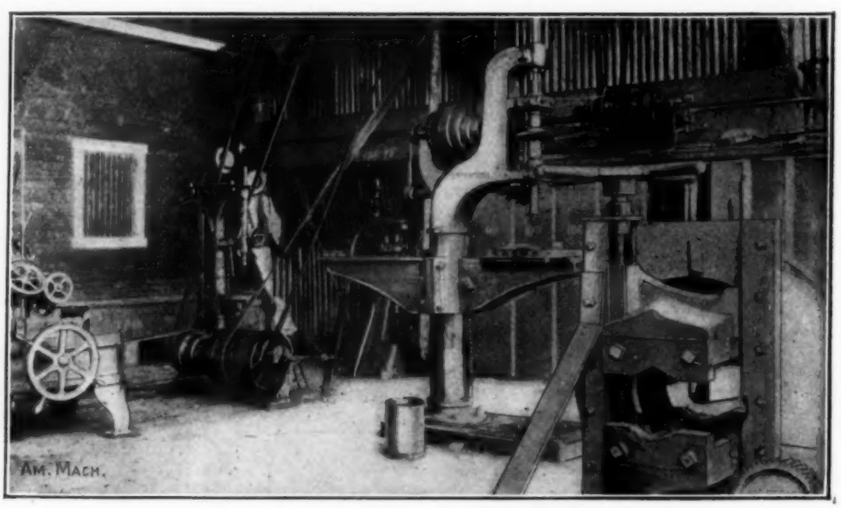


Fig. 23. Corner of Ship Repair Shop

ing used as pump platforms, they were used in carrying material in some cases, and in others they were run over rock and stumps, neither being conductive to long life and satisfactory service in a barge of this character.

A Barge Machine Shop

Following the general well recognized plan of keeping the machinery at work as constantly as possible, Mr. Macfarlane has equipped a barge as a machine shop so that it can be towed alongside any dredge which happens to be in need of minor repairs, and the work done with the least possible delay. This prevents the necessity of towing the dredge to Balboa, and not only saves time, but expense, which seems to be quite carefully looked after on the whole canal proposition.

This is a comparatively small barge, being perhaps 15 to 18 ft. wide by 50 ft. long, power being supplied by a small engine, which is one of the many found among the old French machinery, and turned to use. Steam is supplied by a small upright boiler at one end of the barge, as can be seen in Fig. 18, which also shows the location of the engine at *A*, and indicates how it is necessary to belt diagonally from this to the other side of the barge in order to drive a line shafting which supplies power for the various machines.

It so happens that in this view the most prominent machine is the German shaper bearing the name "Grafenstaden," which must have been a favorite with the French mechanics, as there is a number of them scattered around in the various shops on the Isthmus. To the left is an American-built lathe, and a pipe cutter at the right. Fig. 19 shows the other end of the shop, and the engine is seen in Fig. 20.

While the equipment is not particularly expensive, it includes about all that the machines are likely to need in emergency repair work, including a lathe, driller, shaper, grinder, pipe cutter, work bench, vises, etc.

Using French Steam Boilers and Engines

It is rather difficult to understand how the French engines justified the purchase of so much machinery which was never used, and which probably never will be, although our engineers are utilizing it as far as possible. Fig. 21 shows an instance of this, where a perfectly new boiler with an engine mounted on top is being fitted up for power purposes in an isolated position, where it will do as good service as though it had been bought especially for that purpose.

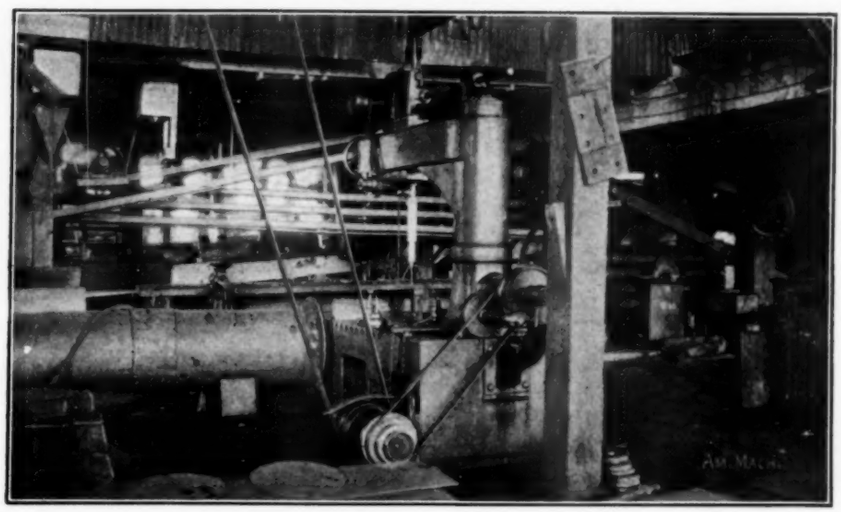


Fig. 24. Another View in the Same Shop

It will be noticed that this is the same type of boiler as illustrated in Fig. 6, in which all the tubes are fastened to the head and come out by removing the bolt which hold the head to the boiler. At the left is a marine boiler which is also a relic of the French days, and which is being prepared for use along the canal.

Machinery which was taken out of an old dredge and housed over to protect it from the weather, is shown in Fig. 22. This is being slowly dismantled as the various parts are required to renew the machinery on other barges along this end of the canal. When the work is in charge of thoroughly practical men, as is the case at Balboa and other points, the saving made by utilizing material of this kind counts up in the total operating cost.

A corner of the small shop in one end of the building connected with the shipways and devoted to repairing the floating equipment is shown in Fig. 23. This shows another of the tools built by Grafenstaden, already mentioned. It also includes a driller of American make, in the corner, and two substantial pipe-cutting machines which can be seen at each side. The ever-present corrugated iron is seen as a guiding, and is, of course, also used for roofing in all cases.

Another driller by the same concern is shown in Fig. 24, this being of the radial type and having a very substantial base and table, as can be seen. This is located under the runway so that the ceiling is low, but a large amount of work is handled in this place. Here are made sheet-metal pipes and similar sheet-metal work as needed at this end of the canal, one of the pipes being shown in the background at the left.

The effect of the low ceiling is to necessitate belting low enough to be dangerous if it were not for the open-work guards, which prevent the men coming in contact with it. These can be seen in the shape of what is apparently a three-rail fence, running across the back of the picture. This is also one of the old buildings and gives some idea of the inconvenient conditions under which some of the work must be performed.

Flush Pipe Bushings from Castings

By Joseph Hyde

Occasion sometimes arises where flush pipe bushings have to be removed from castings. The usual practice is to drill the bushing out, using as large a drill as possible without injuring the threads of the larger hole. In drilling out the bushing it is quite often turned in clear through the hole, stripping or tearing them and probably so spoiling the casting that it has to be scrapped.

Having some of this work to do I decided to try a different way of removing the bushing. This was accomplished by putting the casting on a horizontal driller and tapper, taking a left-hand pipe tap of a size larger than the hole in the bushing and using no feed, but instead a long stick as a lever to force the tap into the hole, the tap being a size larger, and also turning in the opposite direction from which the bushing had been screwed in. The tendency is to unscrew the bushing out, which is done very easily.

The object in using a tap of a size larger was to allow sufficient stock on the bushing to enable the tap to secure a good bite on the bushing in order to turn it out.

When it is considered that these bushings are put in with chain tongs, and made as tight as possible, also faced off flush with the casting, it can be seen that they make a difficult job to remove.

[We have used this same method and also cut four grooves and used a square pieces of steel to remove bushings.—Editor.]

Always keep the sand used for the making of brass castings separate from that used for the making of iron castings.

Tools and Methods of a Vermont Shop

By Ethan Viall

Jigs and tools in use in a shop building a line of woodworking machinery and doing special work.

Boring a large steel casting in a driller.

The Lane Manufacturing Co., Montpelier, Vt., has as complete a set of jigs for the various parts of the machine it builds as any firm in the country. In the manufacture of sawmills, woodworking and stone-handling machinery, which is the nature of this company's business, interchangeability of parts is demanded, for when a mill in some isolated spot receives a part to replace a worn or broken one, it must go into place without a lot of unnecessary fitting, as many times no other means are at hand for machining than that afforded by file and chisel.

Many of the jigs, while representing good modern shop practice, are not of unusual design, consequently only a few

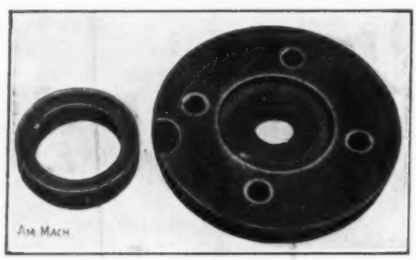


FIG. 1. COUPLING GAGE AND DRILLING JIG

will be described in this article. A surprising thing, however, about the jigs is that a large number of them, though essentially modern, were designed 20 or 25 years ago by the present superintendent, James Canning. In the huge underground storeroom are hundreds of jigs, fixtures, tools and gages, designed or made under his directions.

COUPLING GAGE AND JIG

A reversible gage and a drilling jig for couplings are shown in Figs. 1 and 2, the first showing the gage and jig as used for the male, and the second cut as used for the female half of the coupling. By using a ring gage like this to test the couplings as they are turned, and drilling the bolt holes with this jig, the halves are sure to fit and the holes be in line for any pair that may be selected without reference to whether they were run out in the same lot or not, and a broken part of a coupling may be replaced by one out of stock with the absolute assurance that it will fit without any trouble whatever.

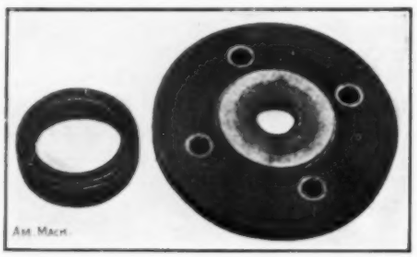


FIG. 2. OPPOSITE SIDE OF GAGE AND JIG

CUTTING DOUBLE THREADS

In the lower part of Fig. 3 are several reamers; those on the left being made from flat bars of steel. They are similar to the large boring bars used with wood lagging on the sides for boring out large tubes or guns, while those on the right are made from forged blocks of steel flattened out to make them large enough for the hole to be reamed.

In the upper part of this cut is a screw 25 inches long, $1\frac{1}{8}$ in. in diameter, cut with left-hand, square, double-thread, ½-in. lead, from cold-rolled steel in 20 minutes, using a follower rest and the tool shown just below it, which is shown enlarged in Fig. 4.

In this illustration *A* is a block that is tongued at *B* to fit the toolpost slot of the slide-rest. *C* and *D* are cutting tools set into the block the proper distance apart from the double thread to be cut, and at the proper angle to clear nicely on the sides, the blades being made from regular cutoff stock. The block *A* is reversible and the cutting tools double-ended, so that either right- or left-hand double threads of the same size may be cut by simply turning the block around and reversing the top clamp *E*. This top clamp has an adjusting screw *F* and a backing block *G* to keep the cutting tools from slipping back while cutting.

PINION DRILLING JIG

A jig used for drilling the pin hole in cast-steel pinions so that it will come exactly between the teeth on each side is shown in Fig. 5. The pinions are first bored and the ends finished, then they are slipped over the plug *A*, being located by the latch *B* and locked by the taper pin *C*. The plug *A* has a bushing in it to guide the drill through the lower part of the pinion, the accuracy of the hole drilled being shown at *D*, which is the exact point where the drill came through.

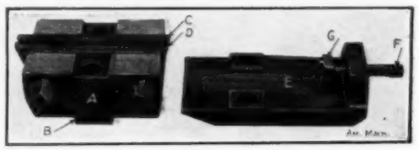


FIG. 4. DOUBLE SCREW CUTTING TOOL

A SET OF COUNTERBORES

Fig. 6 shows a counterbore set of wide range with only two bars. The small bar *A* can counterbore holes from ⅞ to $1\frac{1}{4}$ in., the pilot being ⅞ in. and bushings shown at *B* varying in size by sixteenths being slipped over the pilot for the different sizes. Bar *C* will counterbore holes from $1\frac{1}{4}$ to 2 in., using the bushings or thimbles shown in the two upper rows. These bushings are held onto the pilot by a washer and screw and are slotted so as to fit the cutting blade, which prevents turning when in use; all bushings are ground $\frac{1}{64}$ in. small to allow for the reaming of the holes after they are counterbored. Sets of

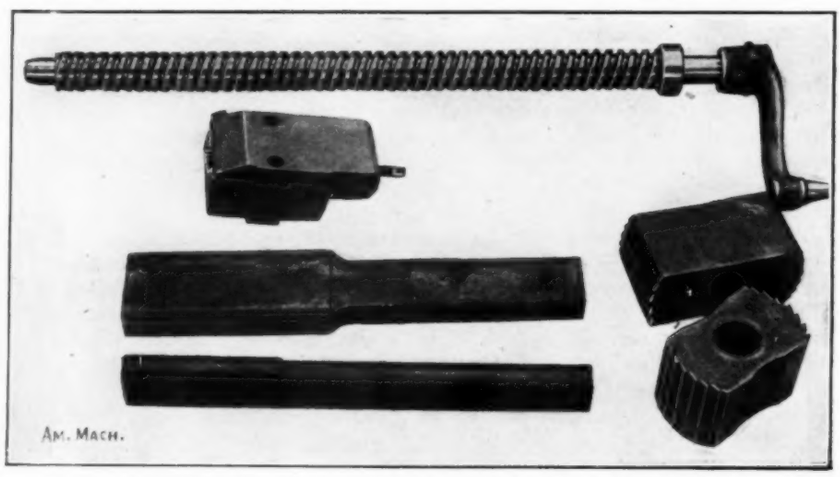


FIG. 3. MILL DOG SCREW AND EMERGENCY REAMERS

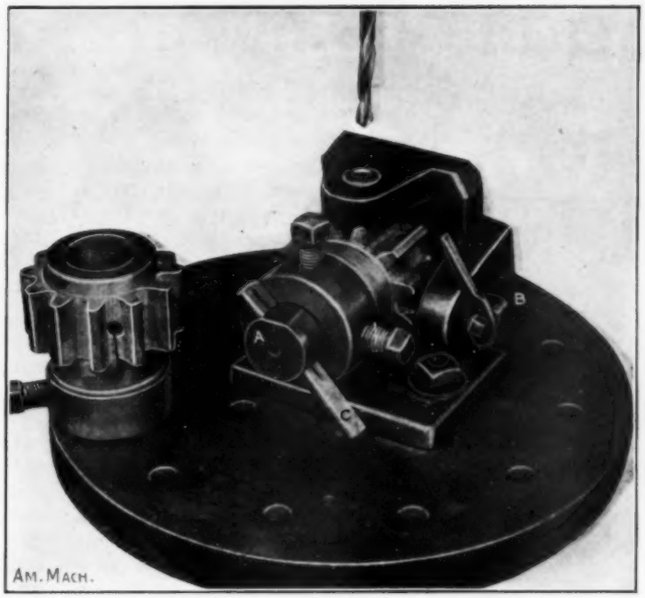


FIG. 5. JIG FOR DRILLING PIN HOLE IN CAST STEEL PINION

FIG. 6. COUNTERBORING SET FOR A WIDE RANGE OF WORK

different length blades for both bars are shown at *D* and *E*, the largest being about four inches in length.

A SLIDING DRILLING JIG

A jig for drilling ten unequally spaced holes in line in a piece is shown in Fig. 7. In use the channeled guide plate *A* is bolted to the driller table, with the bolt hole directly under the spindle and then the part *B* with the piece to be drilled in it, is set into the channel and pushed along as each hole is drilled.

INSERTED TOOTH CUTTERS

A large side mill with inserted teeth is shown at *A*, Fig. 8, the body being made of cast iron which was slotted for the cutting teeth and then a heavy band of iron shrunk on in which the setscrew holes were drilled and tapped. *B* shows an inserted-blade gear cutter made for an emergency job of unusual size. The two halves of the body are made of cast iron and bolted together so as to clamp the cutting teeth, which are also made additionally solid by setscrews placed as shown.

The large 5-inch reamer at *C* is not unusual in any way except that it was made over 25 years ago, and though frequently used is in good shape yet. The blades are simply dovetailed into taper slots, the size being maintained by tapping the blades in slightly, and regrinding.

The side or surface mill at *D* is practically the same as the one at *A*, except that it is larger and headless setscrews

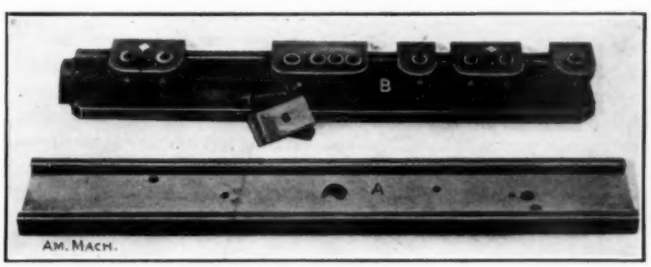


FIG. 7. SLIDING DRILLING JIG

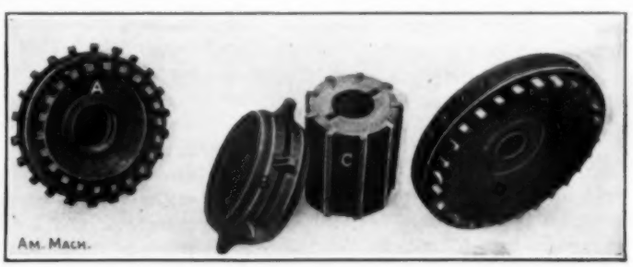


FIG. 8. TOOLS WITH INSERTED CUTTERS

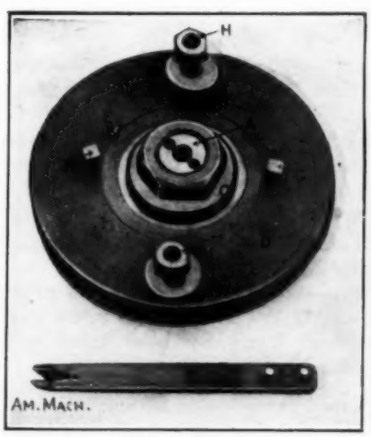


FIG. 9. HEXAGON NUT MILLING FIXTURE

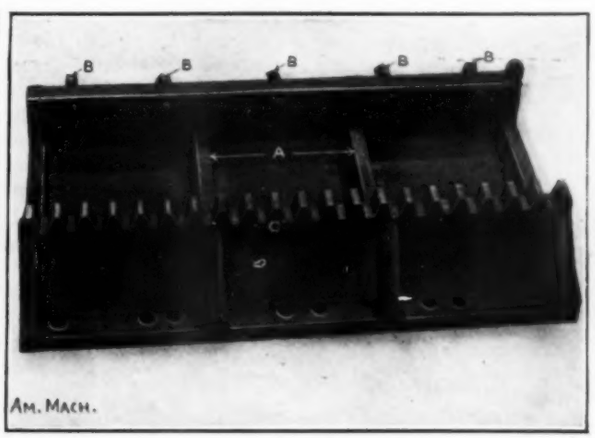


FIG. 10. ROCK PLANING JIG AND TEMPLATE

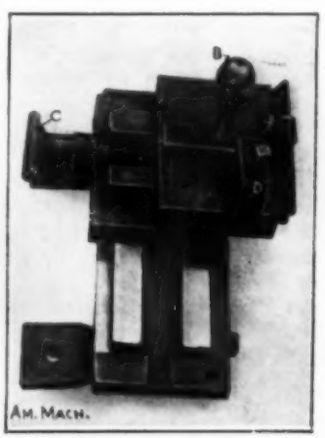


FIG. 11. KNIFE GRINDER

are used, which makes it far less dangerous for the operator.

Milling Large Nuts

Large hexagon shoulder nuts are milled with a straddle mill, by screwing them onto the stud in the center of the fixture shown in Fig. 9, being locked by backing the threaded disk *A* slightly with the wrench *B*. The stud is set into a flanged disk *C*, fitted to the plate *D* with the flange underneath, and is indexed by means of the pin *E* which fits into holes in the flange of the center disk. Setscrews *F* and *G* lock the center disk in place when set, and bolts *H* and *I* clamp the fixture to the T-slots of the miller table.

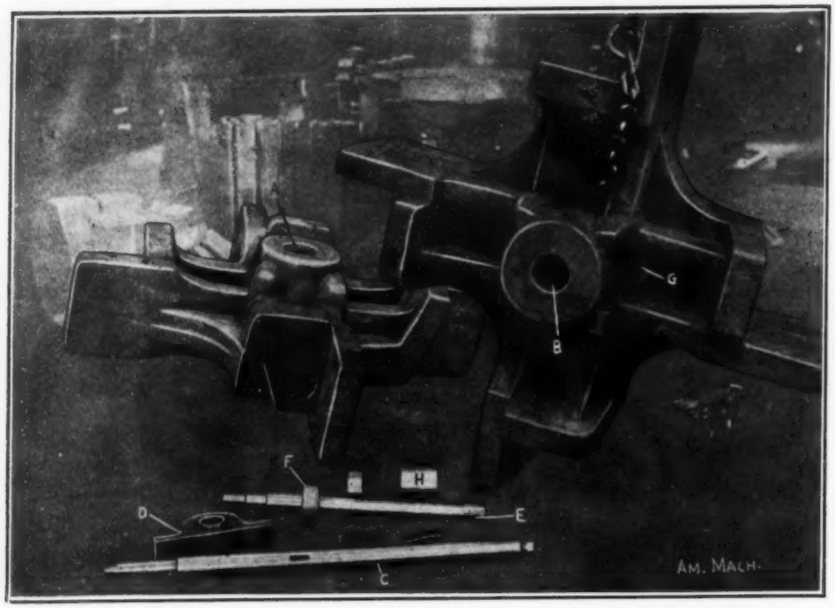


Fig. 12. Large Steel Castings and Set of Boring Tools

Combined Rack Jig and Template

A jig used to hold a number of racks on the planer is seen in Fig. 10. The racks are placed in the jig at *A*, locked by the setscrews *B* and then the teeth are planed by using the template *C* as a guide.

Grinding Knives

Wood planer knives or other similar ones are held in the fixture shown in Fig. 11 while being ground on a plain grinder. The fixture is bolted to the rest, the blade is set into a narrow groove or channel, and clamped by the thumbscrew *A* which presses outward on it, then the blade is ground by running the carriage back and forth by hand, using the handle *B* and feeding with the screw *C*. A bracket and setscrew are placed at *D* to stiffen the feed or to lock the cross-slide altogether, as desired.

Boring in the Driller

Two large steel castings, used for stone planer heads of the revolving disk type, are shown in Fig. 12. These heads had five holes each bored in a radial driller, no boring mill being available for the purpose.

The center holes *A* and *B* were bored with the bar *C*, guided by a bushing underneath, but the holes for the disk bearings in the arms, which were 4x13 in., being blind bottoms, had to be bored in another way. The casting being machined was blocked up, with one of the cored armholes uppermost, then the bracket *D* was clamped to the surface of the arm just above, and in line with, the cored hole. This bracket held a guide bushing for the boring bar *E*.

A cut of about two inches was taken down into the cored hole with a roughing cutter, and then the boring bar was withdrawn, the bracket *D* removed, the bushing *F* slipped over the bar just back of the cutter and the bar again inserted in the hole, the bushing being partly entered in the hole already rough bored, to guide and steady the bar. This bushing was pushed down as the cut progressed until the entire hole, which included a 2-in. gap as shown at *G*, was roughed out, then a finishing cutter was substituted, and using the bushing *H* the hole was cut to size, the results obtained by this method being very satisfactory.

Winthrop Talbot, M. D., in an address before the recent convention of the National Association of Machine Tool Builders, said that from experiments carried on under his direction, it was found that the greatest average comfort from surrounding air conditions came from a temperature of 65 to 70 degrees, a relative accompanying humidity of 50 to 60 per cent. and an air velocity of from 2 to 5 feet per minute.

Uptodateness That Costs Money

By T. E. Pray

It sometimes costs money to be uptodate, using the salesman's definition of that term.

The old man found that out a while ago, when he bought a new-fangled apparatus, which we will call a countershaft because it wasn't.

All that was necessary was to hang it up on the ceiling and belt down to the machine. When the operator wanted a different speed he wiggled a gimcrack a few times and the speed was his, so he could take advantage of every soft spot by speeding up.

Finally the wonder arrived and was put up on a 7-ft. boring mill. It was soon ready to run, and the first thing we discovered was that it was not strong enough to pull the hat off your head. We sent for the salesman to come down. He said the belts were too loose.

They were then tightened up and the mill started, the tool put in the cut and nothing happened, but trouble. The belt smoked and finally slipped off the pulley on the countershaft. After seven minutes of profound thinking the salesman declared there was not enough belt contact. He went back to the office and sent us larger pulleys. These were put on, as well as a smaller one on our lineshaft, and we had a little, a very little improvement.

A few weeks after this affair had been in operation, the inner works played out. Then there was a hurry call for a ladder and finally the ladder was put in as a regular part of the equipment. Presently things got so bad that Bill spent most of the day going up and down that ladder, and at last his patience gave out.

He came to me one day and said: "You'll have to get another man to run that countershaft, because if I try to run that and the mill too, I can't do either."

Then I told him about the scientific advantage, that all he had to do was sit down and watch the cut, and at the proper time wiggle a little rinky-dink.

"Sit down! Why I'm a cross between a kangaroo and an airship with a crick in my neck, and I can't carry enough tools up that ladder to keep that thing going half the time." But he was probably prejudiced.

Well, Bill was finally put on another job, and about this time the old man came around with the supply bill in one hand and an argument in the other. I just looked at him and said, "Well, if you will be in style, pay the bill."

Next week we put the remains away in the scrap bin and put up some nice big cone pulleys and new belts, and everyone was happy.

Always keep molten brass covered with powdered charcoal or a fusible flux.

Graphical Solution of Cone Pulleys

By F. A. Halsey *

Various steps in the solution supplied by different contributors grouped together into a composite whole.

*Editor Emeritus.

The geometrical progression of speeds for driving machines by the cone pulley and back gear, or other means, is now generally accepted as correct. By this is meant that each speed should equal the one next below it, multiplied by a constant ratio. According to Carl G. Barth, the ideal value for this constant ratio in machine-tool practice is the fourth root of two or 1.189. The smallest ratio which Mr. Barth has found in the best speeded lathes of today is somewhat greater than this, being about 1.25. This value is smaller than is usually found in cone pulleys of the usual high ratio type, in which the value, for lathes, ranges between about 1.5 and 1.75.

For feeds of machine tools the geometrical progression is of general, though not universal, application. It is suitable for lathes, planers, boring mills, milling, gear cutting and grinding machines, the principal machine to which it is not suited being the driller.

The data given or assumed are usually the highest and lowest revolutions per minute of the machine spindle, the number of speeds and the diameter of the largest pulley, this last being determined by the available room. The assumed number of speeds should be regarded as a trial number only and subject to correction, should the ratio, due to that number, be found too high or too low.

There are three steps in the process: (1) finding the ratio; (2) finding the speeds; (3) finding the diameters.

Finding the Ratio

To find the constant ratio consult the chart, Fig. 1 (by H. F. Moore, in the American Machinist, Vol. 26, page 299), and proceed as follows: Divide the largest by the smallest r.p.m. of the machine spindle with the back gear out. Find the resulting ratio in the base line as at *a*. Trace upward to the curve for the required number of steps, as at *b*. Trace to the left and read the result from the vertical scale, as at *c*. Divide the value of 0*c* by the value of 0*a*, and the result gives the required ratio.

Finding the Speeds

To find the desired speeds, construct a diagram, as in Fig. 2 (by Professor Sweet in the American Machinist, Volume 21, page 757). Lay off *ab* to any scale and call it unity. Lay off *ac* to the same scale and equal to the ratio found in Fig. 1. For example: Should the ratio be 1.2, *ab* may be made equal to 10 and *ac* to 12 inches. Draw the verticals through *b* and *c* and lay off *bd* to any scale to represent the lowest number of revolutions. Draw *ad* and extend it to *e*, through which draw the horizontal *ef*, when *bf* will represent the second speed to the same scale that *bd* represents the first speed. Proceed in this way as indicated in the diagram, finding points *g*, *h*, *i*, etc., for the various speeds. Should the diagram extend beyond the limits of the paper, lay down the last value found on the paper to a reduced scale, and proceed as before.

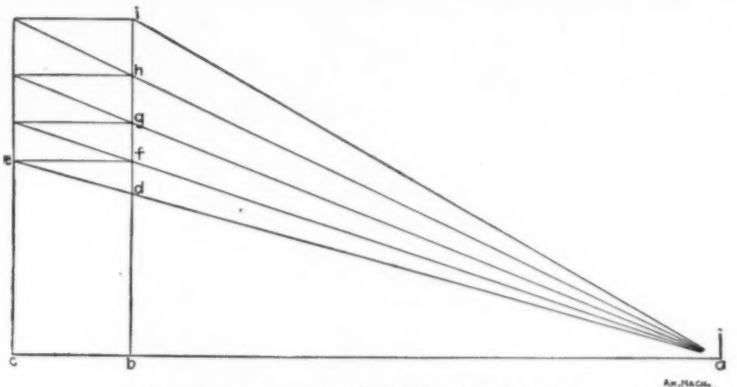


Fig. 2. Diagram for Finding the Speeds

Finding the Diameters

When finding the diameters of the steps three cases exist.

Case I. Crossed belts.

Case II. Open belts with pulleys at sufficient distance apart to make it unnecessary to compensate the tendency of the changing belt angle to alter the length of the belt. All machine tools driven from overhead countershafts are illustrations of this case.

Case III. Open belts with pulleys so near together that the tendency of the changing belt angle to alter the length of the belt must be compensated. Foot-lathe drives and many speed cones are examples of this case.

Since in Case I the belt length is constant, while in Case II it is so nearly constant that it may be regarded as such, the two cases may be treated as one. The distinguishing feature of these cases is that the sum of the diameters of mating steps is constant, while in Case III this sum is not constant.

To find the diameters of the steps for Cases I and II, proceed as in Fig. 3. Draw a horizontal through *a* and from *a* lay down the speeds to the same scale as in Fig. 2, or to any other convenient scale giving *ab*, *ac*, *ad*, etc. Draw a vertical *aO* and assuming *O* at any convenient point draw *bO*, *cO*, *dO*, etc. Lay down R_1 equal to the radius of the largest step and draw *gh*. Assuming equal cones, as is usual, note *h* the intersection of *gh* and *Of*, the highest direct speed line and

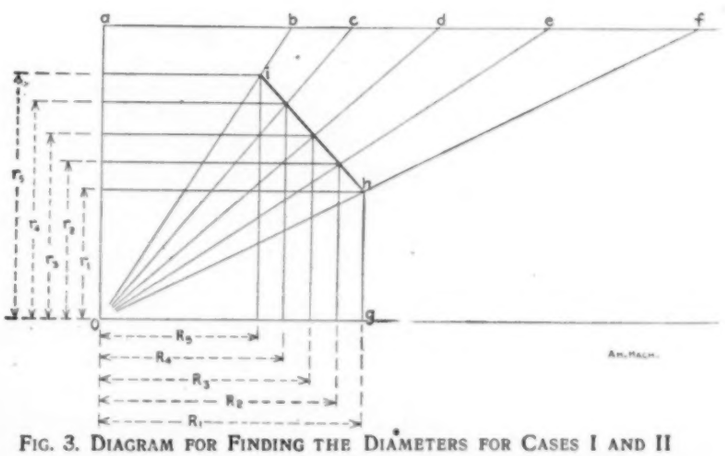


Fig. 3. Diagram for Finding the Diameters for Cases I and II

through *h* draw *hi* at an angle of 45 degrees. Now R_1r_1, R_2r_2, R_3r_3, etc., are the radii of mating steps.

The speed of the countershaft for a pair of cones having an odd number of steps is *ad*. For an even number of steps draw a line *Od* through the center of *hi*, thus finding *ad* which, as before, is the speed of the countershaft.

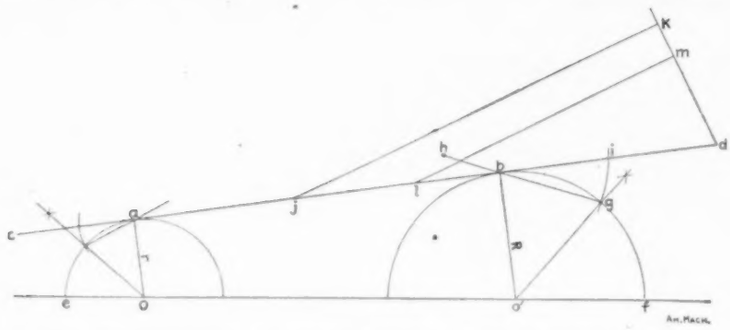


FIG. 4. DIAGRAM FOR FINDING THE MIDDLE STEP FOR CASE III

The ratio of the back gear is the ratio of the lowest direct to the lowest back-gear speed.

COMPENSATING FOR ANGLE OF BELT

To find the diameters for Case III proceed as follows (by H. F. Moore in the AMERICAN MACHINIST, Volume 26, page 299): First draw Fig. 4 in which *R* and *r* represent two of the mating radii. Draw the tangent *ab* and extend it by the distances *ac*, *bd* equal to the length of the arcs *ae*, *bf*.

To do this use Rankine's approximate method ("Machinery and Millwork," page 28) thus: Bisect the arc *bf* at *g* (because Rankine's method should not be used for arcs greater than 90 degrees). Draw the chord *bg* and extend it, making $bh = \frac{bg}{2}$. From *h* as a center strike the arc *gi* giving *bi* = arc *bg*. Repeat *bi* giving *bd* = arc *bf*. Similarly, find *c* giving *ac* = arc *ae* when *cd* obviously equals one-half the length of the belt.

Lay off *dj* equal to 3.1416 to any scale and *dk* equal to unity to the same scale, *dk* making any angle with *cd*. Lay off *cl* = *OO'* and draw *jk* and *lm* parallel to it giving *dm*, which is the radius of the middle step if the cones have an odd number of steps, or of a hypothetical middle step, which is not actually used in case the pulleys are to have an even number of steps.

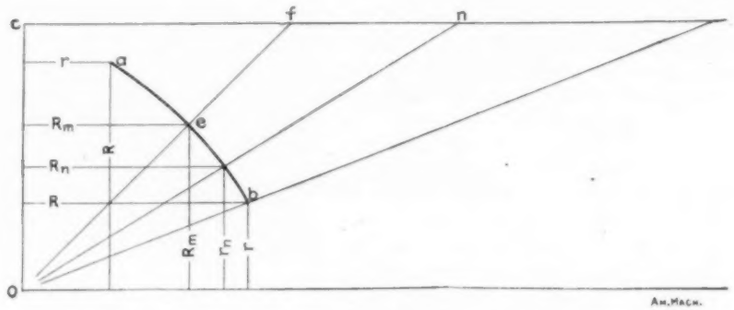


FIG. 5. DIAGRAM FOR FINDING THE DIAMETERS FOR CASE III

In Fig. 5 lay down this radius R_m, as shown (Figs. 4 and 5 are drawn to different scales), thus finding the point *e*. Lay down also the radii of the steps *R*, *r* given at the beginning. Through points *a e b* draw the arc of a circle, and proceed as in Fig. 3, *Rn* and *rn* being mating radii for speed *cn*. As in Fig. 3 the line *cf* gives the speed of the countershaft.

The arc *ab* gives the required compensation for the angle of the belt and provides that a belt length which is correct for one pair of steps will be correct for all others. The circle is not mathematically correct but is a remarkably close approximation.

Mr. Moore's chart, Fig. 1, does not contain sufficient curves to suit cases in which back gears are employed. In such cases we must resort to the logarithmic method of finding the ratio, the method being as follows:

Divide the highest by the lowest r.p.m. and find the logarithm of the result. Divide this by the number of speeds, less one, and find the natural number corresponding to this logarithm and it will be the required ratio.

Perhaps Mr. Moore will be good enough to extend his chart so as to make it apply to cases with back gears, and thus complete a satisfactory general graphical solution of the back-gear problem.

THE HIGH POWER CONE PULLEY

In a paper read before the Cincinnati Metal Trades Association in 1893, H. M. Norris showed how by increasing the diameter of the small step but without increasing the over-all dimensions, the power transmitted by cone pulleys may be greatly increased.

Fig. 6 shows the standard and Fig. 7 the Norris design. The comparative powers transmitted by the two constructions may be best shown by actual figures.

Calling the highest belt speed in Fig. 6—that obtained with the belt on the four-inch—100, the slowest—that on the 12-inch step—will be

$$100 \times \tfrac{4}{12} = 33\tfrac{1}{3}$$

To maintain the same r.p.m. the highest belt speed in Fig. 7 must be

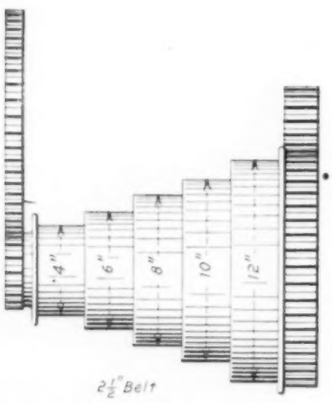


FIG. 6. STANDARD DESIGN OF CONE PULLEY

FIG. 7. NORRIS DESIGN OF CONE PULLEY

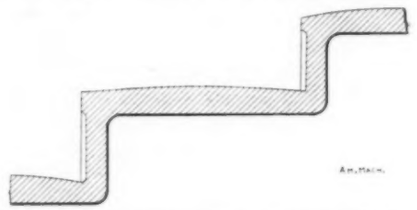


FIG. 8. PREVENTING THE CLIMBING TENDENCY OF THE BELT

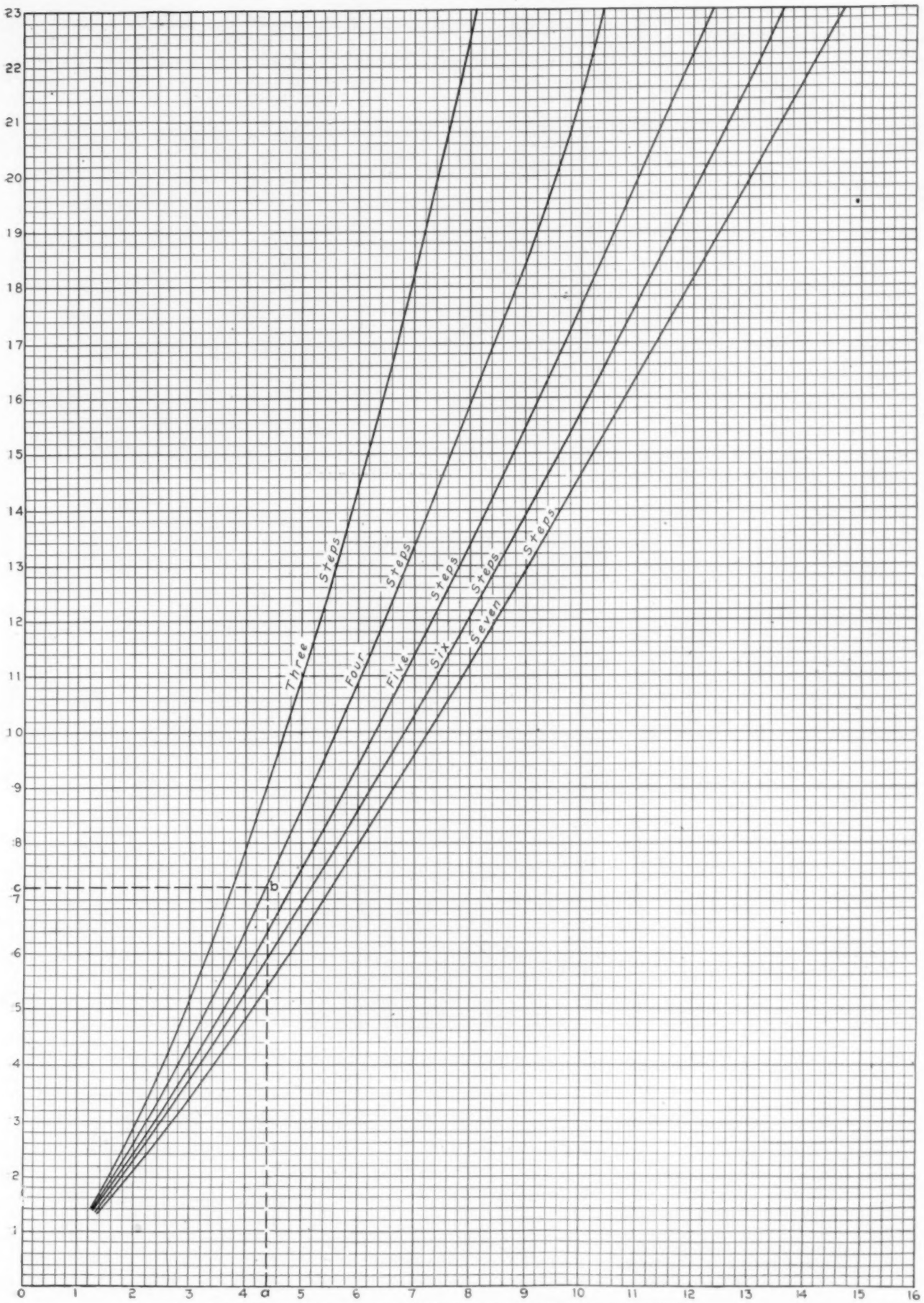


FIG. 1. CHART FOR FINDING THE RATIO OF THE GEOMETRICAL PROGRESSION

$$100 \times \frac{11\frac{17}{33}}{4} = 288+$$

and the lowest will be

$$288 \times \frac{11\frac{17}{33}}{13} = 255+$$

The smallest step of Fig. 6 is too small for a double belt, while the opposite is true for Fig. 7. To obtain the ratio of power capacities we must multiply the belt-speed ratio by a suitable ratio for this, say $\frac{10}{7}$ and also by the ratio of the belt widths $\frac{4}{2\frac{1}{2}}$. Doing this we obtain:

$$\frac{\textit{Power capacity Fig. 7 small step}}{\textit{Power capacity Fig. 6 small step}} = \frac{288}{100} \times$$

$$\frac{10}{7} \times \frac{4}{2\frac{1}{2}} = 6.5+$$

$$\frac{\textit{Power capacity Fig. 7 large step}}{\textit{Power capacity Fig. 6 large step}} = \frac{255}{33\frac{1}{3}} \times$$

$$\frac{10}{7} \times \frac{4}{2\frac{1}{2}} = 17.5-$$

That is, the capacity of Fig. 7 on the small step is 6½ and on the large step, where the gain is most needed, 17½ times that of Fig. 6.

So large an increase as this is, of course, seldom needed. Many cone-pulley drives are, however, weak in capacity at the slow speeds and Mr. Norris' plan points out the remedy.

The cone pulley shown in Fig. 7 gives a smaller total range of speeds than the one shown in Fig. 6, and if the range of Fig. 6 is required additional back gears are necessary. If double gears be used a five-step cone will give 15 speeds against 10 in Fig. 6, while a three-step cone will give 9. Fifteen are unnecessary and 9 are, in most cases, enough. It is this reduction in the number of steps that gives the increase in belt width. The additional back gear will, however, increase the over-all length of the headstock slightly if the entire gain is to be realized.

The tendency of the belt to climb the side of the pulley against which it runs may be prevented by recessing the sides of the steps as shown in Fig. 8.

Repairs in a Texas Railway Shop

In making up a new reverse-lever quadrant for a locomotive, the old quadrant was bolted to the new one and both put in the traverse-head shaper shown in Fig. 1. By this means it was easy to use the old quadrant as a guide templet in shaping out the teeth of the new one and save all work of laying out. It was also easier than planing to a line.

Fig. 2 shows an improvised method of grinding in steam-pipe joints. The T-head is fastened on the floor near the bottom of the column at the left. Two boards *A* project and carry rods which prevent the upper end of the pipe from falling outward.

The handles *B* are clamped around the pipe and the grinding can easily be done by one or two men.

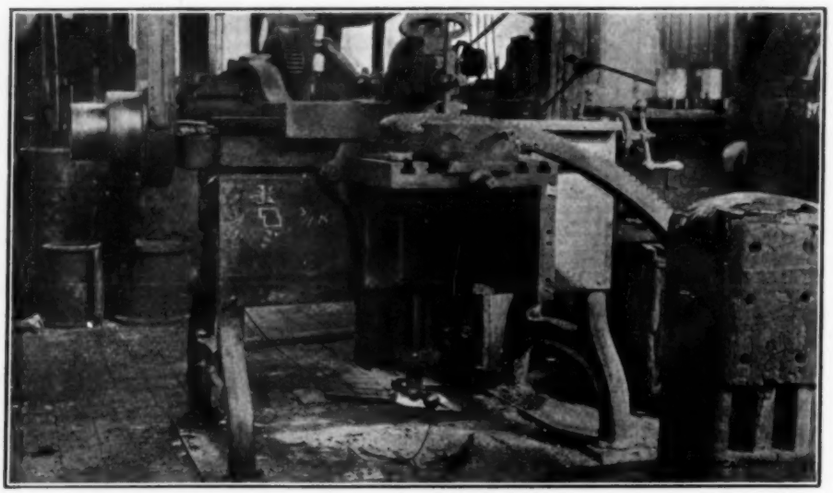


FIG. 1. PLANING A NEW REVERSE QUADRANT TO MATCH THE OLD ONE

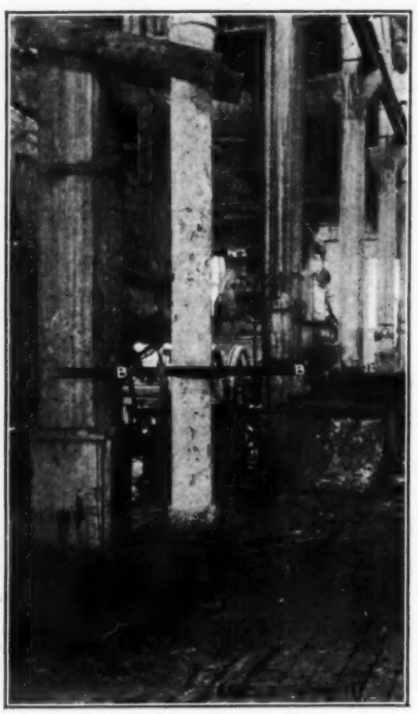


FIG. 2. GRINDING IN A STEAM-PIPE JOINT

These were found in the shops of the Texas & Pacific Railroad at Fort Worth, Tex., through the courtesy of Master Mechanic, G. W. Deats.

Aluminum for Transmission Lines

From the Bulletin *de l'Industrie Minerale*, it is noted that aluminum is now extensively used in Europe for electric transmission lines. Many of the principal lines on the coast of the Mediterranean are of that metal; and the Société d' Electricité is about to use it exclusively in the valley of the Rhône. The advantage of aluminum over copper is one of the first cost, and, therefore, depends entirely on the relative price of those metals. For an equal electrical resistance, the weight of an aluminum line is half that of copper (1 to 1.98). If, therefore, an aluminum cable is used instead of a copper one, when the cost of the former per pound is, relatively to the latter, as 3 to 2, a saving of 25 per cent. will be effected.

The usual formula for distance between supports allows a longer stretch of aluminum than of copper wire, a condition which suggests a further saving in supports. But it is pointed out that when wind pressure is taken account of, the distance for aluminum works out as only nine-tenths of that which is suitable for copper. Where an expensive form of support is adopted this disadvantage may go far to neutralize the gain in the cost of the conductor. A very small saving in first cost would not be a sufficient set-off against the more careful work and special points required for an aluminum line. Moreover, if the metal is not absolutely pure, aluminum is chemically affected by copper, carbon, silicium and especially sodium.

In the Canal zone the following warning notice has been posted: "Alcohol, gasoline, benzine, naphtha or kerosene are easily ignited. They must be kept in a cool, well ventilated place, remote from lights or fires. Lamps or burners must never be filled while lighted. The pouring of any of these fluids on a lighted fire or live coals, or on inflammable substances which it is the purpose to ignite, is dangerous to life and is absolutely prohibited." While the notice of warning contains self-evident propositions it is posted in conspicuous places on the principle of the ounce of prevention maxim.

Holding Gears for Grinding

Editorial Correspondence

Several methods of chucking hardened gears, utilizing draw-in chucks to hold them by the roots of the teeth, by the pitch-line and by the points of the teeth.

One of the many problems which have been brought out by the development of automobile manufacture, is the method of holding gears for grinding after hardening, so that the hole may be ground concentric with the pitch line of the gear teeth. The problem is to hold the gear from some point or points which had a definite and fixed relation to the gear teeth when they were cut. If the outside of the gear blank were absolutely true with its axis of rotation on the gear cutter, the gear could easily be chucked from the outside by simply dividing up any inequalities as to groundness which the gear had undergone during the hardening process. Or, if the milling cutter be formed so as to cut the outer ends of the teeth at the same time it is finishing the curved tooth space, this method could be easily used.

In a similar way we can use the bottoms of the teeth perhaps more easily than in any other way, provided the finishing cutter goes clear to the bottom. But as the bottom of the tooth is merely for clearness, many gear men let the roughing or stocking cutter go deeper than the finishing cutter, so as to save it as much work as possible. Where this is done, it is not much safer to depend on the bottom of the teeth than on the outside, and it becomes necessary to hold gears by their curved faces, whether at the pitch line or not it is not so important.

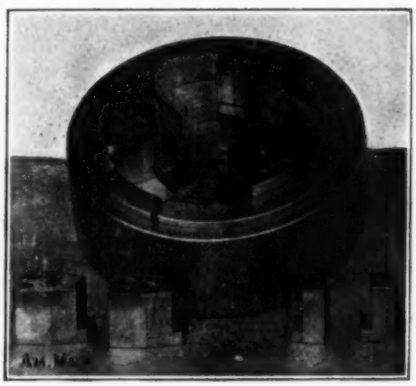


FIG. 1. HOLDING BY OUTSIDE OF GEARS

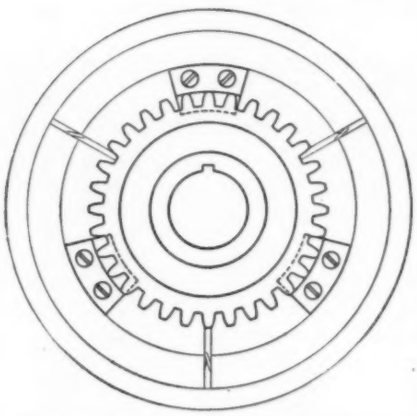


FIG. 2. DETAIL OF OUTSIDE HOLDING CHUCK

Figs. 1 to 6 show the three methods which have been mentioned in connection with the use of draw-in chucks, as made by the Heald Machine Co. Fig. 1 requires no explanation whatever, and is shown in detail in Fig. 2. In Figs. 3 and 4, where the gear is held by the points of the jaws reaching to the bottom of the teeth, the same general principle prevails, except that the jaws are free to move in the direction of the slot, so as to accommodate gears of approximately the same diameter, although having different numbers of teeth.

Fig. 5 shows a somewhat similar arrangement, the difference being that the holding portion of the jaw consists of a hardened-steel roll, which fits in between the teeth at approximately the pitch line and holds them from this point. This is known as pitch-line control.

One advantage of the method of root control is that the chuck jaws bear directly on solid metal in a straight line with the web of the gear, and that it is a very simple matter to maintain the accuracy of the contact point by simply truing them with a grinding wheel whenever it may become necessary.

The use of five jaws has been suggested and tried in some cases, with the idea of securing still greater accuracy, but the results obtained by using three jaws are so far ahead of the work usually secured in the average shop, that the three-jaw chuck is recommended for general use.

A New Chuck with Double Rolls

Working along this line, the Heald company has developed a new chuck, using pitch-line control, and at the same time securing greater accuracy than heretofore when rollers were used. As will be seen from Fig. 6, each jaw carries two hardened-steel rollers having conical ends, and being held by loosely fitted conical recesses, which allow perfect freedom to the rolls *R*, and at the same time prevent them dropping out of place, unless the retaining plate *P* is removed. These rolls fit in between the teeth of the gear to be ground, adjusting themselves easily to any inequalities of the tooth surface, and seating against hardened-steel plates, which are inserted in the collet jaws when they are drawn down into place to hold the gear for grinding.

This method gives great latitude in the holding of gears by their curved faces, and in allowing for any distortion which may occur in hardening of the gears. It also allows the jaws to be maintained with great accuracy, as by removing the retaining plate *P*, and taking out the rolls, the hardened-steel plates, against which they bear, can be easily ground to remove any inaccuracy due to either wear or distortion, although the latter is hardly possible in a chuck of this description.

FIG. 3. HOLDING BY BOTTOM OF TEETH

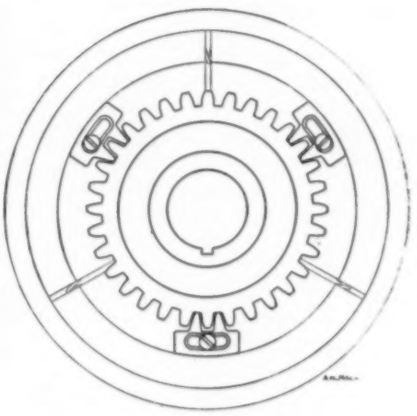


FIG. 4. DETAIL OF BOTTOM HOLDING CHUCK

The general appearance of these chucks in use can be easily seen from the halftone illustration.

The latest development in holding gears by this method is shown in Fig. 7. This

is simply a modification of the double-roller chuck, in which the two hardened rolls are spread so as to skip one tooth space.

This secures the double advantage of distributing the holding points more equally around the gear and of taking

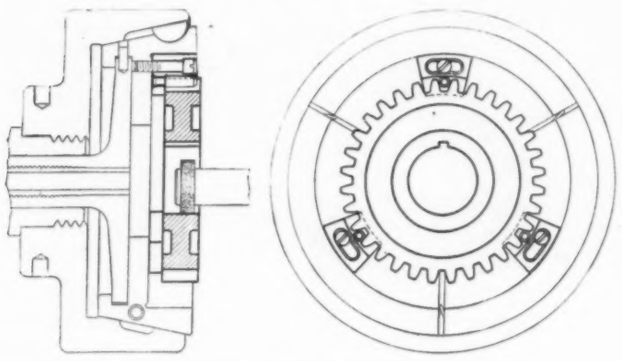


FIG. 5. DETAIL OF PITCH LINE CONTROL

care of any distortion of the gear teeth which occurred in hardening. One of the most noticeable effects of this distortion is to produce a wide and a narrow space next to each other. This arrangement

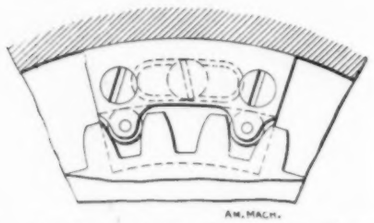


FIG. 7. HOLDING BY ALTERNATE TEETH

skips the wide or the narrow space, as the case may be, and is much more apt to hold the gear by spaces having approximately uniform width.

A NINE-POINT CHUCK

A still further modification of this idea is shown in Fig. 8, in which each of the three holding jaws carries three hardened steel rolls, placed far enough apart to fit in every third tooth space. This gives largely increased contact all around the gear, and in the case of gears which have become ellipitical in hardening should give a more accurate chucking by dividing up their inaccuracy.

It will also be seen that the hardened steel rolls are held in a different manner than in either of the other chucks. These rolls are mounted in a retaining ring, so as to hang loosely by the neck under the head, and are perfectly free to adjust themselves between the curved spaces of the gear teeth and the backing surface of the hardened steel jaws, which form a part of the draw-in chuck.

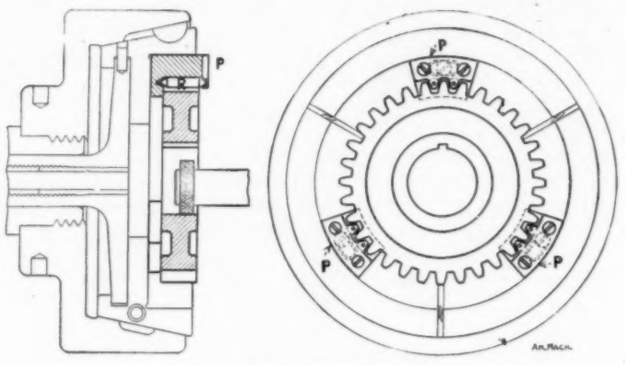


FIG. 6. DETAIL OF DOUBLE ROLL JAWS

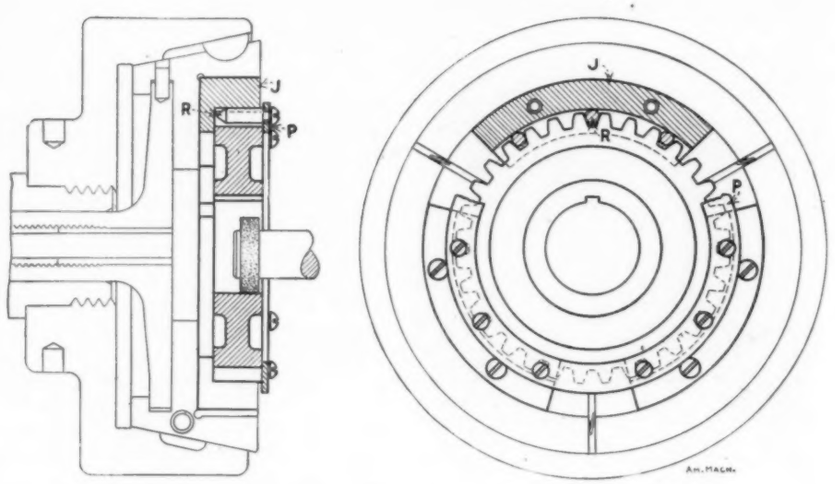


FIG. 8. A NINE-POINT CHUCK

The retaining ring carrying the roll is entirely independent of the chuck, and comes out with the gear. To use, it is simply slipped over the gear to be ground, and the whole thing inserted in the chuck. This makes it very easy to keep both the rolls and the hardened steel jaws perfectly clean and tends to increase the accuracy obtained.

HOLDING BEVEL PINIONS AND GEARS

Perhaps bevel pinions and gears give more trouble than spur gears, owing to the increased difficulty of holding the in-

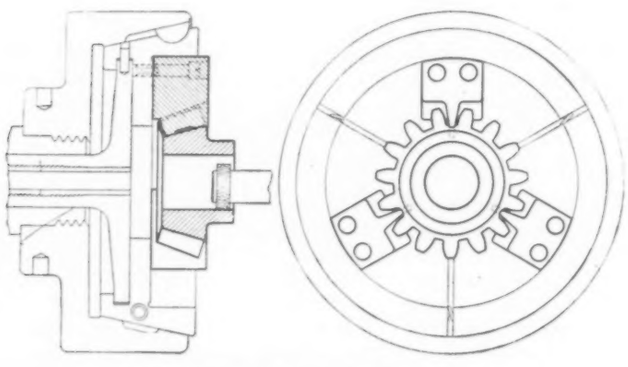


FIG. 9. HOLDING SMALL BEVEL GEARS

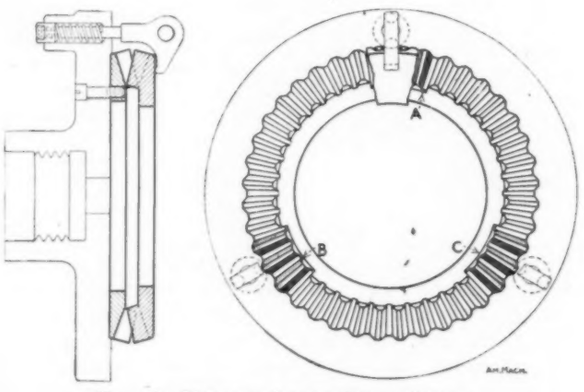


FIG 10. HOLDING LARGE BEVEL GEARS

clined surfaces so as to revolve truly both with regards to diameter and length. Fig. 9 shows a form of chuck for holding bevel pinions by the bottom of the teeth. The only difference between this and the

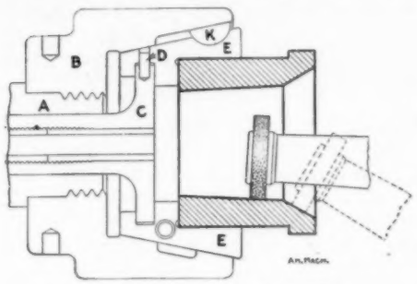


FIG. 11. CHUCK FOR PLAIN WORK

spur-gear chuck is the use of a single-pointed holding jaw, which is not adjustable and which is ground to the proper angle to hold the gear to be ground.

It will be noticed in the section view that the bearing surface is relieved in the center and also that there is a projection lip, which comes down on the outside of the gear and prevents any tendency to slip outward.

Holding devices for bevel gears have also been made to include rollers in a similar manner as for spur gears, but they are more or less complicated, and the plain jaws shown have proved very satisfactory on bevel pinions in most cases.

A NEAT CENTERING DEVICE

When it comes to holding large bevel gears, such as are used in the drives for automobiles, the method shown in Fig. 10 has been found very satisfactory and can easily be adopted in any shop.

One of the gears themselves is selected and about three-quarters of the inner points on the teeth are cut away so as to leave three points containing three or

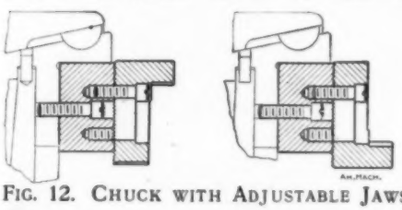


FIG. 12. CHUCK WITH ADJUSTABLE JAWS

four teeth each, as can be seen at *A*, *B* and *C*, in Fig. 10. This holding gear is then fastened permanently and accurately to the faceplate and forms the centering and driving device for all gears on this size and kind which are to be ground. It is only necessary to place the gear to be ground so that the teeth will fit the teeth which have been allowed to remain and project from the holding gear, and these accurately center any gear put in mesh with them. As they also form a positive drive, it is only necessary to hold the gear to be ground in contact with these teeth by the spring-controlled hook bolt shown, to hold the work in place during the grinding operation. This makes a very simple and accurate method of holding work of this kind.

Should this master gear wear, new contact surfaces can be secured by grinding back the high teeth which have been left, and the original accuracy restored.

CHUCKS FOR PLAIN WORK

To show the draw-in construction, as applied to all work to be ground, one of the chucks for cylindrical work is shown in Fig. 11. The body *B* screws on the work spindle *A*, the draw-in sleeve *C*, running through this and controlling the jaw *E*, both by the flange on the sleeve and the pin *D*. A Woodruff key *K* is sunk into the jaw and slides in a keyway in the body *B*, to prevent the jaws turning under any strain whatever.

Where a variety of sizes of gears are to be ground and where the quantity is not sufficient to warrant having special chucks for each size, chucks having adjustable jaws are recommended, as is shown in Fig. 12. By moving the screw which holds the false jaw from one hole to the other and utilizing the slot in the false jaw, work can be held from $\frac{5}{8}$ in. to $8\frac{1}{8}$ in. in diameter, which gives a very wide range. By omitting the adjustable jaws and putting in jaws for either root or pitch-line control, this collet chuck is very convenient.

The methods shown are the latest practice recommended by the Heald Machine Co., and should prove of value to those having internal grinding to be done.

Making Forming Tools

BY J. S. ATKINSON

Herewith is given a method for forming correct profiles in male and female circular forming tools. This principle is doubtless carried out in many tool rooms, but I am convinced that this is not the general practice, a more common way being to form the female tool with the periphery of a milling cutter, or an old reamer. The male tool is often formed by a circular form milling cutter. It should be obvious to the reader that although tools made in this manner are often considered good enough, they are incorrect, the profile formed on the work being that of an oval and not a true circle.

To overcome this error on female tools, I have made a master form tool like *A* in Fig. 1. This tool is ground on the periphery, and can also be disk ground on the cutting face to eliminate drag. It can readily be seen that this will form a true circular profile, if the face of *B* be parallel with the face of *C*. The holder *A* can accommodate various sizes of tools *B*.

Fig. 2 is the same principle carried out for forming male tools. In this *D* is the master which can be formed with the periphery of a milling cutter. The cutting face *E* is ground square with the form which has been milled. This should be set parallel with the face of *F*. In this case the tool may also be prevented from dragging in the manner shown.

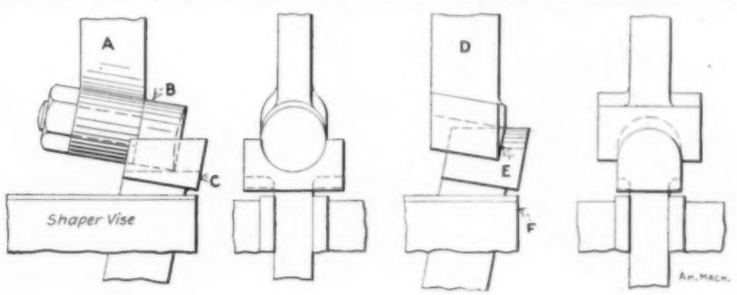


FIG. 1 FIG. 2

MAKING FORMING TOOLS

Effect on Steel of Cutting by Oxyacetylene

In an Austrian contemporary the results of tests made to determine the effect on the metal near the cut made by oxyacetylene blowpipe are given.

Tests were made with two mild steels, a nickel steel, and a chrome-nickel steel, the latter being of the armor-plate variety, and tried in the hardened condition. Test pieces were cut out by the ordinary method and by the oxyacetylene blowpipe, and tensile tests made. It was found that in the case of the mild steels and of the nickel steel no change in the quality of the metal had occurred, but in the case of the hardened chrome-nickel steel the material had been considerably softened, the effect being greatest nearest the cut, and gradually diminishing as the test piece was farther away from the cut; the effect was noticeable even at $1\frac{3}{8}$ in. from the cut.

A confirmation of this result was obtained by firing 38 caliber hardened-steel projectiles at a plate, the edge of which had been cut by the oxyacetylene blowpipe, and noting the depth of penetration at different distances from the edge. At $\frac{1}{10}$ in. from the edge the penetration was 0.005 in.; at $\frac{1}{3}$ in. the penetration was reduced to 0.003 in., and at $1\frac{3}{10}$ in., 0.001 in., which was also the depth of penetration over the remainder of the plate. A chemical analysis disclosed no changes, but micrograph sections confirmed the results stated above.

New Model Vertical Surface Grinder

The illustrations, Figs. 1 and 2, show respectively front and rear views of a new vertical surface grinder, recently completed by the Pratt & Whitney Co., Hartford, Conn.

While this machine, along general lines, resembles their well known grinder, which has been in common use for the last three years, many improvements have been incorporated and weight and rigidity added.

A distinctive feature of this grinder is its ability to handle either plain or circular grinding with an equal degree of efficiency. In order to adapt the machine for both types of grinding, the essential features for both have been included in its design.

Editorial Correspondence

A new model of the well-known Pratt & Whitney vertical surface grinder, which will handle either plain or circular grinding efficiently.

The Bed

The bed of the new grinder is considerably heavier than that of the former model, and the internal braces are disposed to assure ample rigidity and continued accuracy. The bearing surfaces for the table are of the V- and flat type and of an ample width.

The Upright

The upright is of heavier construction than formerly. It is bolted to the bed. It carries wide dovetailed ways for the accommodation of the head.

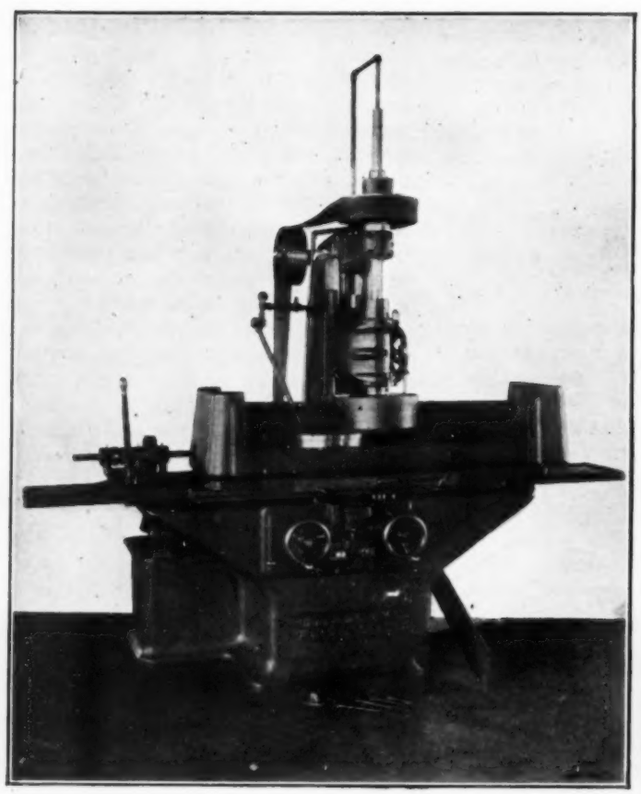
The Head

The head has been made longer and heavier. It is fitted to the dovetailed ways of the upright, and is provided with a taper gib which may readily be adjusted to take up wear. The head is perfectly balanced and its vertical adjustment is consequently very sensitive and accurately controlled through the feed mechanism. This mechanism is operated either by hand or automatically. The automatic feeds are obtainable through a ratchet-wheel, which is provided with an automatic knockoff for disengaging the feed. Graduations permit the vertical movement of the head to be accurately gaged. Ten gradations of automatic vertical feed are obtainable from 0.0002 to 0.002 in., rising by 0.0002 inch.

The Spindle

The spindle is of special steel. The lower spindle bearing in the head is made in halves and lined with babbitt metal. This bearing was tried out in the former model and proved satisfactory. Some of the bearings under observation have run for three years under the most severe conditions without perceptible wear.

The thrust is taken against ball bearings, the proper adjustment being automatically controlled. The driving pulley is mounted on a hardened and ground bearing entirely independent of the spindle; thus the pull of the belt is not transmitted to the spindle. The upper spindle bearing is bronze, journaled inside the hardened and ground pulley bearing. One spindle speed is provided. The spindle driving pulley is 14 in. diameter and the belt 4 in. wide.



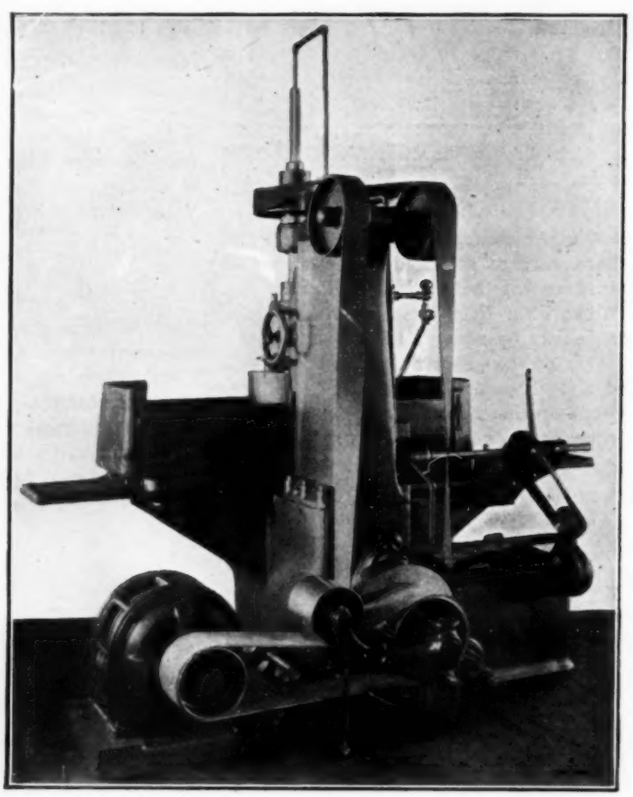


Fig. 1 Front and Rear View of Motor-driven Surface Grinder Fig. 2

The Grinding Wheel

The grinding wheel is cup-shaped, 14 in. diameter, 4 in. high and 1¼ in. in the

wall. It covers the full width of the work, thereby assuring flatness and high production.

The Table

The table has a working surface 11⅜x 36 in., is very heavy and is ribbed on the under side to prevent warping and to resist torsional stresses. Both the table and bed are scraped to masters. The table is slightly longer than the bed and the traversing action tends to keep both the table and bed true. The ways are automatically lubricated by means of rolls located in the bed and running in oil reservoirs. Guards are provided which at all times protect the ways from dust and dirt.

The Table Feeds

Two power table feeds are provided, 0.029 and 0.088 in. per turn of the spindle; these are equivalent to a travel of 34 and 102 in. per minute of the table. They are instantly obtained while the machine is in motion through a gearbox, operated by a lever in front of the machine. This lever also serves as a means for starting and stopping the table. The feed mechanism is provided with a safety device whereby the table is stopped before any breakage can occur.

The Reversing Mechanism

The reversing mechanism will reverse the table within a space of 0.001 in.—a valuable feature on some classes of work. The length of stroke is controlled by adjustable dogs attached to the table.

Hand feed is also provided for the table. It is operated by means of a handwheel in front of the machine, one turn of the handwheel traversing the table 1.14 in.

Water Supply

Each machine is provided with a pump capable of supplying an abundance of water. The water is carried through the spindle, centrifugal force driving the water between the wheel and the work and keeping both cool and free from dust. The water in passing through the spindle also serves to keep it at a uniform temperature and prevent overheating. An outside stream is also provided to convey water to the outside of the wheel and also for cleaning purposes.

A high-water guard is provided for the table, which prevents the escape of the water. A guard on the wheel also assists in controlling the centrifugal action of the water. A large water tank is located at the back of the machine and is readily accessible for cleaning. The water drains back from the machine into this.

The Drive

The machine is either belt driven from a countershaft or with motor drive, as shown in Figs. 1 and 2. The motor base is readily attached to the column and is provided with an automatic belt tightener. A 15-hp. constant-speed motor is recommended. This should run about 1200 r.p.m. While on a large percentage of work, probably not over 5 hp. is necessary, when it is desired to work the machine to its capacity, 15 hp. is none too much.

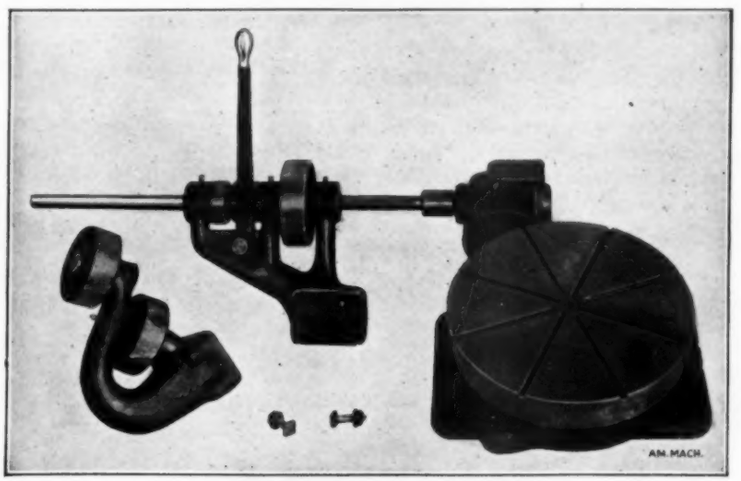


Fig. 3. The Rotary Grinding Chuck

Rotary Chuck

The machine in Figs. 1 and 2 is shown equipped with the rotary chuck illustrated in detail in Figs. 3 and 4. These chucks are either plain, as shown in Fig. 5, or magnetic, as shown in Fig. 4. They are both 16 in. diameter, the plain chuck being 7 in. high, and the magnetic 10 in. high. The driving units are placed outside the water guards, absolutely preventing the entrance of water. The chucks may be tilted, permitting the the grinding of convex or concave work, such as saws, cutters, etc.

Rectangular Magnetic Chuck

The rectangular magnetic chuck shown in Fig. 5, has a working surface 7¼x31 in., and is 4 in. high. It is readily applied to the table and is so constructed that it is waterproof; water may, therefore, be freely used without danger of short-circuiting.

Fig. 4. The Rotary Magnetic Chuck

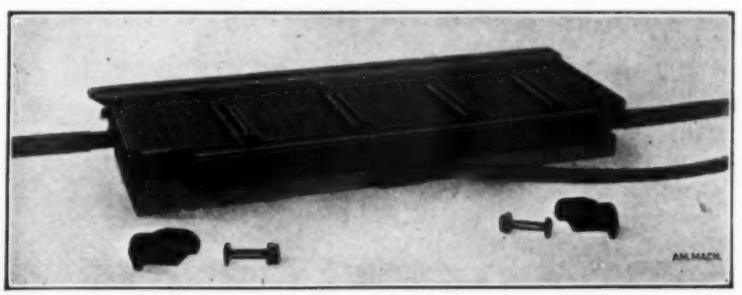


Fig. 5. Rectangular Magnetic Chuck

Blower For Magnetic Chucks

Both rectangular and circular magnetic chucks are designed with air chambers, through which a slight current of air should be circulated, in order to keep the chucks absolutely free from moisture. The necessary air is obtained from one of the spindle idler pulleys, which is made to serve as a blower. The connection is by means of a rubber tube from the blower to the chuck.

The maximum distance from the table top to a new grinding wheel is 14 in. The maximum table travel is 36 in. The machine occupies floor space 6 ft. 6 in. by 12 ft. 8 in., and weighs 6000 lb.

It is stated that about 75 per cent. of the pig iron produced in the world is made into steel of one grade or another, the remainder being used as cast iron in some of its various forms.

Wire Rope Splicing

By F. L. Johnson

Wire rope is susceptible of almost perfect splicing and the operation is so simple that it may be learned in an hour by any mechanic who is at all skillful in the use of ordinary tools. For all kinds of transmission rope the long splice is used and should not be less than 16 ft. in length for ½-in. rope and increasing to 30 ft. for the larger sizes.

Where the splicing must be done in position, rope blocks are used to draw the wire rope taut, as in Fig. 1, care being taken to make fast far enough from the ends to leave plenty of room for the splice and the men who make it. If possible, it is better to hold the rope taut, mark the splice on both ends, by securely winding with No. 20 annealed-iron wire, throw it off the sheaves and make the splice on the floor or staging, as may be most convenient.

The strands of both ends are unlaid, back to the points wound with wire, the hemp core cut off and the ends brought

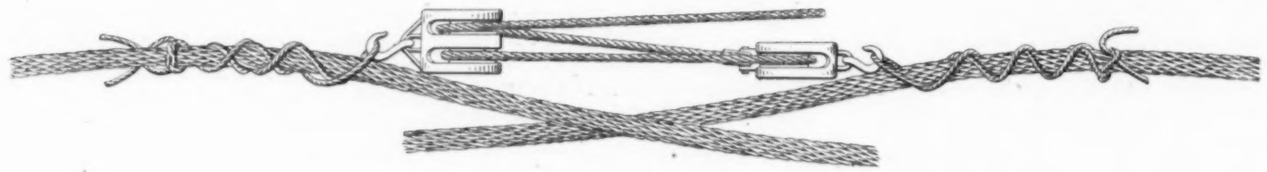
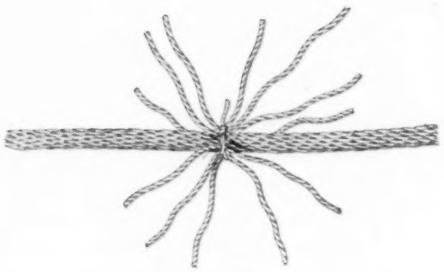


Fig. 1.



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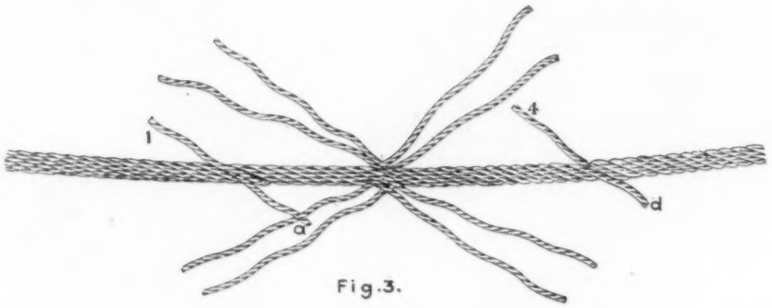


Fig. 3.

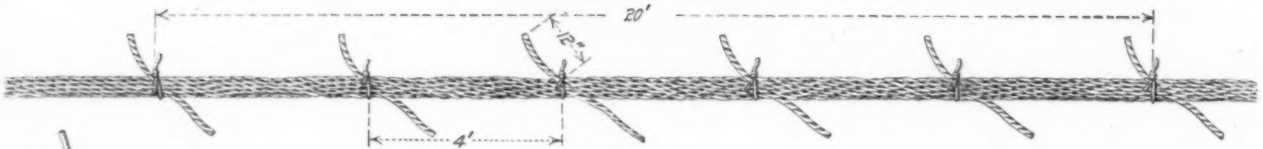


Fig. 4.

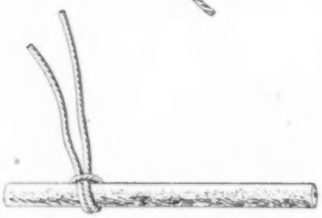


Fig. 5.

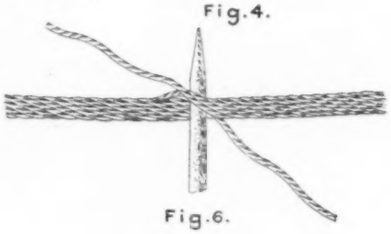


Fig. 6.

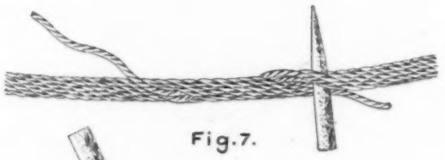


Fig. 7.

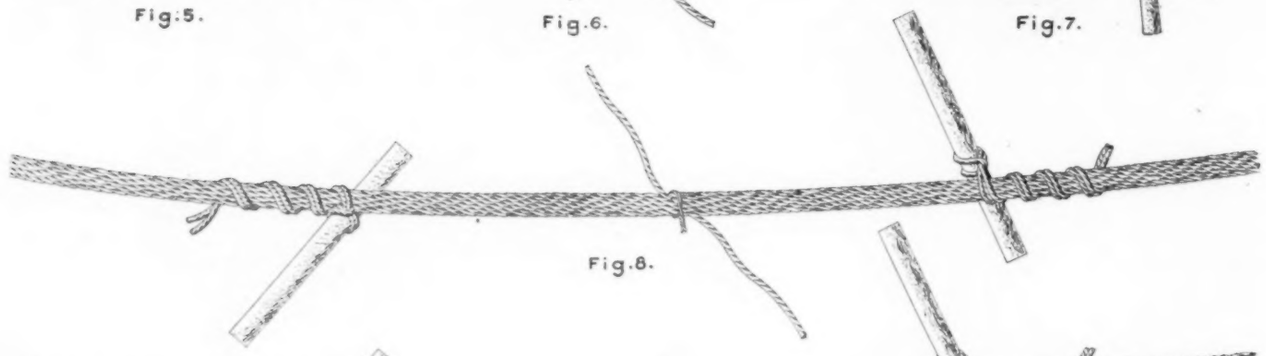


Fig. 8.

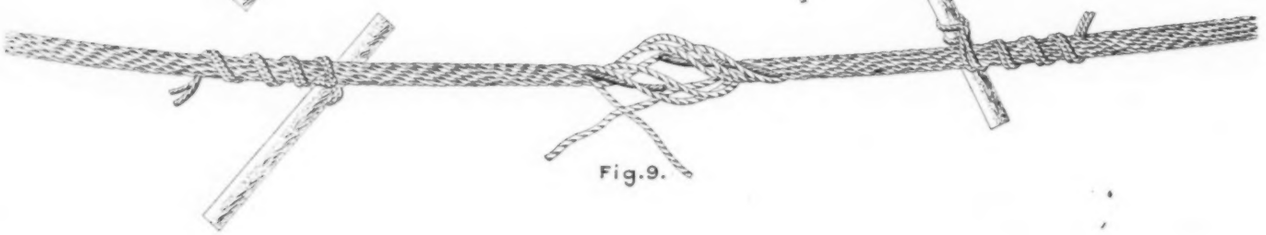


Fig. 9.

together with the strands interlaced, Fig. 2. Any strand, as *a*, is unlaid and closely followed by the corresponding strand 1 of the other end of the rope which is pressed closely into the groove left by the unlaid strand. The unwinding of one strand and the inwinding of the other are continued until all but about 12 in. of strand 1 is inlaid, when *a* is cut off at the same length with a sharp chisel, 1 and *a*, Fig. 3. Strands 4 and *d* are next treated in the same way and the process is repeated with each pair of strands until all are laid and cut as in Fig. 4.

Around each point where the free strands cross, a few turns of stout twine are made and the length of the splice is bent and worked in all directions until the tension in all the strands is equal and the rope as flexible there as elsewhere. If this is not done and there is more tension in some of the strands than in others when a stress is put on the rope, these strands will pull into the rope, making a bad looking and weak splice.

Next, the open or free ends of the 12 strands are carefully trimmed and served or wound with fine wire, and two rope and stick clamps, Fig. 5, are secured to the rope, one on each side of an end crossing, as in Fig. 8, for the purpose of aiding in tucking the strand ends into the middle of the rope.

There are two ways of tucking in these ends. They are first straightened with a mallet. The long ends of the rope-clamp handles are twisted in opposite directions, separating the strands and exposing the hemp core, which is cut off and pulled out between the points to where the tucked-in strands will reach and the ends forced into the place formerly occupied by the core.

This is most easily done with the aid of a marlin spike, which is passed over the strand which is to be tucked and under two strands of the rope, Fig. 6, and moved along the rope spirally following the lay and forcing the free end into the core space, Fig. 7.

In the other method the strands are more widely separated by untwisting the rope with the clamps, Fig. 9, slipping the free end in between the strands and correcting slight kinks by the use of a mallet.

The order in which the ends are tucked in is immaterial. Some operators prefer to tuck all the ends pointing in one direction before any of those pointing the opposite way, while others finish each pair of ends in series.

If the foregoing directions are intelligently followed the splice will be uniform with the rest of the rope, of nearly equal strength throughout, and after a few hours' use it will be almost impossible to detect the splice.

Figuring Spiral Gears

By Chas. H. Logue

As there is no direct solution for a pair of spiral gears their calculation is a tedious process and the result must be found by trial. But aside from this, the greatest handicap is occasioned by the immense number of tables, methods and formulas which have been given for our guidance. Some of this information is useful in checking, but the bulk misleads and confuses. One method after another has been tried in a more or less vain attempt at a solution. Why not, therefore, select the simplest method—one that will fulfill all requirements—and stick to it? A table is a nuisance unless it gives all possible solutions.

As numerous calculations are absolutely necessary this formula should not involve division by large or fractional numbers and should contain the fewest possible operations. To present such a formula is the purpose of this article. Let

C = Center distance,
P = Diametral pitch,
N_1 = Number of teeth in the driver,
N_2 = Number of teeth in the follower,
β = Spiral angle of driver,
α = Spiral angle of follower.

Then,

$$2C = \frac{(\textit{secant}\ \beta\ N_1) + (\textit{secant}\ \alpha\ N_2)}{P}$$

That is, the sum of the secant of the driving angle times the number of teeth in the driver, and the secant of the follower angle times the number of teeth in it divided by the diametral pitch equals twice the center distance. This formula is derived as follows: The secant of the spiral angle times the pitch diameter of a spur gear of the same number of teeth and pitch equals the pitch diameter of a spiral gear of that angle, the pitch of the spur gear being the same as the normal pitch of the spiral gear. Now for a spur gear the number of teeth divided by the diametral pitch equals the pitch diameter. Therefore, *the secant of the spiral angle* $\times \frac{N}{P} =$ *the pitch diameter of a spiral gear.* The combined pitch diameters times the center distance are equal to

$$\left(\textit{Secant}\ \beta \times \frac{N_1}{P}\right) + \left(\textit{secant}\ \alpha \times \frac{N_2}{P}\right)$$

or (*secant* $\beta\ N_1$) + (*secant* $\alpha\ N_2$) for one diametral pitch.

The quantity *secant* $\beta\ N_1$ is the pitch diameter for the driver and *secant* $\alpha\ N_2$ is the pitch diameter of the follower. To obtain the center distance for any other pitch, it is simply necessary to divide this last result by that pitch.

A table of secants will furnish constants covering the entire range of angles; and therefore, all possible solutions for a pair of gears. After long experience in calculating spiral gears I can recommend the formula given as the best and simplest for all cases.

To assist in its use the following point should be kept in mind:

1. The diameter of a spiral gear increases with its angle.

2. Therefore, the diameter of the follower will reduce as the driving angle is increased, although not necessarily in the same ratio.

3. It is quite possible for the center distance to remain practically constant through quite a range of angles, the follower decreasing as the driver is increased. This is especially true when the gear having the greater number of teeth is the driver.

4. If the center distance is too great when the driving angle is 45 degrees—it must not go below that in any case—a lower number of teeth must be selected for both driver and follower, while maintaining the same ratio, and another trial made using a much higher angle for the driver.

5. The center distance will increase with the angle of the driver. This increase is more rapid when reducing than when increasing the speed of the follower.

6. The number of teeth selected for each trial must be in proportion to the desired ratio.

7. Fifty-five degrees is commonly accepted as the most efficient driving angle.

To solve a pair of spiral gears, select secants for the desired angles, assuming the normal pitch, try out the value of $2C$ with trial numbers of teeth for driver and follower.

If the value $2C$ is too small increase the number of teeth and try again. A very few calculations will show the number of teeth to secure the closest result.

If the center distance thus found is not as desired the angles must be shifted, keeping in mind the general laws governing the change of the center distance with the angle.

It is often found that when the desired center distances is reached the driving angle is too large to be desirable. The only alternative is to change the normal pitch and try again. A slide rule will give approximate results.

When there are limitations placed on the diameter of one or both of the gears the following formula is of value. It may also serve as a check on the above calculations. The pitch diameters are assumed.

$$\textit{Tan.}\ \beta = \frac{\left(\begin{matrix}\textit{pitch diameter of driver} \times \\ \textit{number of revolutions of driver}\end{matrix}\right)}{\left(\begin{matrix}\textit{pitch diameter of follower} \times \\ \textit{number of revolutions of follower}\end{matrix}\right)}$$

This will set a limit on the driving angle β, to exceed which means that the gear will be too large.

It is not intended to make this a complete paper on spiral gears, for once the diameter and angles are determined the rest is easy.

Cost Figuring in an Electrical Plant

By H. F. MacLane*

An interpretation of that part of cost keeping which deals simply with compiling the cost of the apparatus manufactured.

The article explains this work as it is handled by a large electrical manufacturing company.

*Chief cost clerk, Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

At the start, I wish to call attention to the fact that this article deals with cost figuring, not cost keeping. Cost keeping is too broad a subject to cover within the space permitted here. Cost figuring I am interpreting as that part of cost keeping which deals simply with compiling the cost of apparatus manufactured; and even so, this can be covered only in a general way, as will be readily understood when it is considered that many volumes have been written on different individual phases of the subject. In short, this article will be confined almost entirely to explaining this work as it is handled by the Westinghouse Electric & Manufacturing Co., rather than to the different ways in which it could be done, although it may be considered desirable to get away from our practices in one or two places.

The accompanying diagram shows the different steps in figuring costs. The dark spaces represent the different elements that have to be considered, and the blank spaces show the result we get by the addition of each of these items.

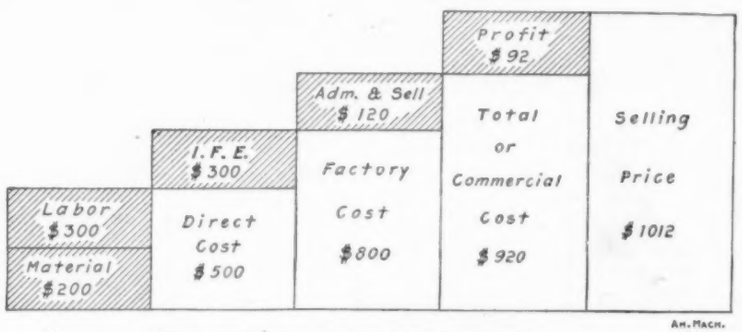
As you see, by adding the "direct material" and the "direct labor" together, we get the "prime" or "direct cost," that is, the actual cost of doing the work without considering the accessories that are necessary. When we add to this prime cost these accessories or, in other words, the expense of operating the plant, we get the "factory cost," or the cost of manufacturing an article complete and storing or shipping it. By adding the "selling and administration cost" to the factory cost, we get the "total or commercial cost." And the "selling price" is determined by adding to this "commercial cost" the desired profit.

It is the factory cost with which we have the most to do; by "we" I mean those of us who are employed in the works department. This factory cost, as has been explained, is made up of three parts: the "direct material," the "direct labor" and the "indirect expenses." In some concerns the factory cost is divided into four parts: the "indirect material" and "indirect labor" being kept separate the same as are the "direct material" and "direct labor;" but our company does not make this distinction, simply considering this all as "indirect expense."

Material Cost

The manner of arriving at the material cost is comparatively simple, and easy to comprehend. The material used in making a piece of apparatus and which becomes a part of the apparatus, is included in the cost of the part at the same figure at which we buy it from the outside. For example, if porcelain insulators are used on a transformer, they are included in the material cost of the transformer at the same price at which we buy them from the pottery manufacturers. In the same way, the material cost of a finished shaft is the amount we paid for the rough shaft from the outside.

You will see by this that we consider as material cost the price paid for material bought outside, whether that material is raw or finished; that is, the material may have had labor performed on it by the people who sell it to us, but as this labor is not performed by us we are not interested, only in a general way, as to whether the price we pay covers labor or material or both; for as far as we are concerned, it is simply material, whether raw or finished.



How the Final Selling Price Is Made Up

At the risk of complicating my explanation, I must explain here how, under our departmentalized accounting system, we consider our own labor as material cost under certain conditions. This is when one division of the works makes a part or an article which is later assembled in another division, being sold to the latter the same as if from the outside. Aside from the fact that we would not want to include our original labor the second time in the labor cost, there is another and very important reason why this first labor is considered material when compiling the cost at the time the part is used in assembling it later on, and that is, as will be explained in detail later, because in determining the amount of indirect expense to be included in the cost of a piece of apparatus we add a certain percentage of the direct labor, and you can see that if labor on which expense had once before been added were to be again included as labor, it would result in too large an amount being included in the factory cost for indirect expense. For example, one division of the works makes some coils and sells them to the storekeeper at a cost which includes the amount paid for the material, the labor in the division making the coils and a certain percentage of this labor which is considered sufficient to cover the indirect expense in that division connected with making these coils. Now, if another division should requisition these coils from the storekeeper for use in building a railway motor, it would be just the same as if they requisitioned something that the storekeeper had bought from an outside concern instead of from one of our own divisions, and the amount that the division using the coils would pay for them would be considered material value, and the labor on which a percentage would be added to cover the indirect expense in this division would be only the labor in the latter in building the motor. And this would be handled in exactly the same way if the transaction were short-circuited and the coils sold by the division making them direct to the division using them, instead of being handled through the storekeeper. However, when an analysis is made of the cost of the complete motor, the total actual material cost and total actual labor cost, together with the total amount included for indirect expense, are shown for each department; that is, so much material, labor and expense in the division making the coils and so much material, labor and expense in the division that assembled them in the motor. So that in the final analysis the exact total cost of labor and material is set out separately.

Another feature in figuring material cost that is an exception to the regular practice of considering it the original

price paid for the material is where, in machining raw material, the value of the scrap is worth considering. We have, for example, a brass or bronze endplate which, finished, weighs 50 lb., but which before machining weighed 90 lb. Therefore, we bought (either from outside or from our own brass foundry) 90 lb. of raw brass, say, at 18c. a lb., or for $16.20; and ordinarily we would say that the material cost of the endplate was, therefore, $16.20. But, in addition to having on hand the finished 50-lb. endplate, we also have 40 lb. of scrap brass, and we can sell this scrap brass (again, either to outsiders or to our own brass foundry) for, say, 10c. a lb., or $4. Therefore, the material value is not $16.20 but $12.20; or, in other words, in this case the material value is not the amount paid for the raw material, but rather is this amount less the value of the scrap we get in machining. So you see that where any value is attached to the scrap we make in machining material, the value of that material must be considered the original cost less the value of this scrap.

Before leaving the subject of material, I will give you just one illustration that will show what happens when every detail is not handled exactly right in figuring costs. Due to a misunderstanding, when our present cost system was first started about a year and a half ago, in charging for the output of the screw-machine department, the material cost was shown as the price paid for the raw material; that is, if 10 bolts were made from a brass rod that weighed 10 lb. when received, and for which we paid 15c. a lb., or $1.50 for the rod, the material value of each of the 10 bolts was considered at one-tenth of $1.50, or 15c. each.

The screw-machine account started to show such a regular surplus in the credits over the charges each month; that is, the actual inventory on the floor grew so steadily higher than the book values, that we knew something must be wrong; and in getting into the matter it was found that the scrap department was allowing the screw-machine account credit for scrap-brass borings and turnings sent out to the amount of about $3000 each month—a credit which, of course, should have been taken into consideration in figuring the material cost included in the factory cost charged for the output of the department. In other words, we were misleading the management and the sales department in regard to the cost of our screw-machine work to the extent of $3000 a month. To show you that this scrap credit was an item of no small importance, I may add (and some will likely be surprised at the statement) that the value of this scrap is enough that I believe we would be able to get many of our brass parts machined without charge by outside concerns, if we would give them the borings and turnings made in machining.

Labor Cost

The next step in cost figuring or the next block, as shown by the diagram—and that which, added to the "material," gives us the "prime" or "direct cost"—is "labor."

Like the material cost, the labor cost of an article can be definitely determined under most wage plans. This is why we refer to them as the direct labor and direct material cost, and the total of the two as the prime or direct cost. However, the direct labor cost is not so easily determined as the direct material cost; and the degree of difficulty encountered depends very largely upon the particular wage system in use.

While it is not my purpose to describe the different wage systems in use, in passing I may name the day-work plan, piece work, differential rate, premium, bonus, profit-sharing and stock distributing as some of the more common systems for paying wages; and there are a number of others that might be mentioned, but they are in most cases more or less modifications of those I have named. Our methods of payment are confined almost altogether to day work, piece work and premium; in the order named, the three oldest systems of wage payment, and probably the simplest.

We endeavor to obtain the correct labor cost of our apparatus by having each workman report on a separate time slip the actual time put in on each job he works on, this time agreeing with the time he took out and turned in the slip. Each of these slips is figured and posted to a labor record, divided to order numbers. When the order is finished, either the time slips or duplicates of them or the labor record to which the time slips were posted are checked with the records showing the operations required, to see that we have a record of labor on all these operations for each piece on the order—and that no more have been paid for than are called for by the order. The total thus obtained is taken as the actual labor cost of the order.

In order to make sure that we get the correct labor cost of each order and, therefore, of each part on each order, our system calls for a check to be made to see that the total amount of the payroll of check employees in each department (and our productive labor is all performed by check employees) agrees with the total direct-labor record on stock orders in that department, as determined by the plan described above, plus the total labor charged to indirect expense by check employees.

It is especially important that the correct direct-labor cost be obtained in every case, as the indirect cost of manufacturing an article, under some plans (including ours, as will be explained later) is arbitrarily determined by adding a certain percentage of the direct-labor cost, so that inevitably each mistake in the direct-labor figures is multiplied in arriving at the total cost.

For example, as outlined in the accompanying table, we figure the direct-labor cost of a generator to be $300, and say it has been found that for each dollar spent for direct labor in the division in which the generator is built we are spending a dollar for expense; in other words, our expense is running 100% of our direct labor. Therefore, we figure the indirect cost of the generator to be also $300; now, say the material cost is $200, and we have a factory cost of $800 for the machine. But suppose the cost department has, by mistake, omitted $50 in totaling the direct labor from its labor records; this means that the indirect expense is also out this amount, or $50, the total amount out in the factory cost thus being $100. To show that the seriousness does not stop here, we will say that the sales department adds 15% to the factory cost to determine the commercial cost, and let us assume that to the commercial cost 10% is added for profit in arriving at the selling price. As we were $100 low on the factory cost we lose 15% of $100, or $15, in determining the commercial cost, so that at this stage in the computation our figures are incorrect to the extent of $115. In the same way we lose 10% profit on $115, or $11.50, and this means we are $126.50 low in setting our selling price—all because were were out $50 on the direct labor in the first place. I can easily imagine that the company would not make much profit on this kind of figuring. The machine sold for $23 less than it cost.

This illustration has been given (and it is not an exaggerated case, by any means) in order to show the very great importance of getting the direct-labor cost correct, and this means, as you will agree, that the time slips which everyone in the shop more or less handles are really the foundation and the most important part of our cost system, and the time clerk's work in seeing that the correct time put in on each job is charged to that job is a mighty important business, and deserving of the coöperation of everyone in any way concerned. If you need anything further to impress you with the importance of getting the correct direct-labor cost, it may be added that a cost once worked up will often be used for all machines of this particular type delivered for six months or a year.

Indirect Factory Expense

The third block on the diagram, and the last step in arriving at the "factory cost," is the "indirect expense." This is also known as "overhead," "burden," etc. And it is in the proper distribution

or allocating of this item that the science of cost keeping comes in.

In speaking of indirect expense one means everything, after the direct labor and material, that it costs to produce an article; and this includes no end of expense, such as the pay of foremen, clerks, inspectors and others, taxes, rent, heat, light, handling material, cleaning factory, cost of buildings, repairs to buildings, depreciation in the value of buildings, and, in the same way, the cost, repairs and depreciation of tools and machinery, power for operating machines, defective design, labor and material, loss on surplus material scrapped, interest on the stockholders' investment, interest on mortgages or other debts, etc.

I have stated that the handling of indirect expense constituted the science of cost keeping; and to emphasize my statement, I will take the liberty of saying that I do not believe anyone under any system gets the actual indirect cost of manufacturing any one article allocated to that article, where a concern makes more than one thing, and it might be added that under the plan we operate my statement is particularly applicable to this company.

Without attempting to describe any plan except the one we use, some of the methods for distributing indirect expense may be mentioned as (1) direct-labor cost, (2) direct-labor hours, (3) direct labor and material, (4) old-machine rate, (5) new machine rate, (6) fixed machine rate, and (7) new pay rate. The first named (the direct-labor cost plan) is by far the simplest, but is also very inaccurate; this is the one we use.

There is one method of distributing indirect expense that, for want of a better name, is sometimes referred to as the "blanket" plan, that it is claimed some small manufacturers use when they know nothing about cost keeping; but writers on cost keeping refuse to include this in naming the methods for distributing expense. Under this plan the manufacturer will total all his expenses during the year, except his labor and material, and divide this figure by his total sales during the year to find the ratio of the total expense to the total sales. This ratio is used throughout the next year on all articles sold, regardless of the actual conditions or variations.

Our direct-labor cost plan provides for adding a certain percentage to the direct-labor cost of an article to cover the indirect expense of making the article; this percentage being arrived at by finding the relation of the total factory expense to the total direct labor, somewhat after the manner followed by the merchant using the "blanket" plan. But we improve on the blanket plan by determining as closely as possible the relation of the expense to the direct labor by main divisions of the works and, in some cases, by subdepartments, and we check up these figures monthly instead of annually. In doing this we also endeavor to charge each division or department with the expense properly chargeable to that division or department and with its proper share of the general charges that must be divided over the whole works; but there is no denying the fact that these charges cannot be divided absolutely correctly. In order to determine as nearly as possible the expense chargeable to each section we divide these expenses into three classes: Class *A*, those which can be fairly accurately allocated to individual subdepartments of a division; class *B*, those that can be assigned to to certain main divisions; and class *C*, those expenses which come under the head of "general" and which apply to the works as a whole (taxes, storekeeping, etc.). These last are distributed to the different divisions as correctly as possible, the conditions and circumstances in connection with each kind of expense being taken into consideration in making the distribution.

Perhaps I can make this a little plainer. The productive labor in one of our divisions during a certain month is $4000; productive labor is simply our name for direct labor, and is the labor expended by workmen actually working on apparatus in the department, and the total amount of this is obtained from the semi-monthly payroll of check men by deducting from the total roll the amount paid check men for expense labor. During this same month the expense chargeable to this division amounts to $6000; this amount includes such class *A* and class *B* expenses as the pay of the men handling material, the pay of janitors in the division, the salaries of clerks, foremen and others working in the division, the loss for defective workmanship and defective material, the cost of new tools received in the division, the repairs to tools already in the division and other such direct expenses charged to the division during the month; and also includes the division's share of class *C* expenses that are general expenses of the company and that have to be divided among the different divisions as correctly as is possible, such as the cost for watchman, expense of fire brigade, operation and maintenance of the industrial and standard-gage railways, salaries of paymaster and payroll-division offices, storekeeping expense, expense of the shipping department, and other general charges, such as were mentioned farther back.

In this way we find that the expense of the division during the month was $6000, compared to $4000 productive labor, or in other words the total indirect expense during the month equaled 150% of the total direct labor. Therefore, for each dollar paid for direct labor in the division there is $1.50 expense; and under our plan we assume that this expense is distributed uniformly, that is, that each dollar of direct labor carries along the same amount of expense as every other dollar, so, after totaling the direct labor on a piece of apparatus in the manner already explained, we multiply this amount by 150% to determine the indirect cost of the apparatus, this indirect cost being added to the direct material and direct labor, i.e., to the prime or direct cost, and the total considered the actual factory cost of the article.

I have intimated once or twice that the direct-labor cost plan of determining the indirect cost of an article is inaccurate, and this is a fact as the following comparison will show you. A green man, rated at 18c. and operating a driller, works five hours on a job, which makes the direct-labor cost 90c., and, under the above plan, the indirect expense connected with doing this job is 150% of 90c., or $1.35. Another man, a finished mechanic, receiving 36c. an hour, assembling an article at a bench, also works five hours on his job, which makes the direct-labor cost $1.80, and 150% of this makes the indirect cost $2.70. Now, here are two jobs taking the same length of time, and the indirect expense of one is set at $1.35, and of the other at $2.70; not only that, but the job done on the driller actually takes considerably more expense than the one shown as costing $2.70 for expense, because it required an expensive machine, while the other is an assembling job; the machine takes up more floor space than the bench, power is required to operate the machine, and the 18c. man requires more supervision than the mechanic. So you will see that although the job done on the driller really required considerably more indirect expense than the other, it is shown as costing $1.35 and the other $2.70.

However, there is another point of view I wish to emphasize by my statement that our plan for determining the indirect cost of an article is simple but inaccurate. I might say it is "simple and comparatively inexpensive"; in other words, we realize that our plan does not give us the actual cost in all cases, but to get it under some other plan would be much more expensive; and another thing, if we were to adopt one of the more accurate and consequently more complex systems for getting our costs, I can easily imagine what a wail there would be from those misguided ones who complain that the present plan is a hardship and that the requirements of the cost department are all tomfoolery.

Development

"Development cost" is another item that under our accounting system is included in the factory cost, but which has not been shown in Fig. 1 as one of the regular steps in cost figuring, inasmuch as it is only sometimes included. Development enters into the cost of a piece of apparatus only when it is a new design

being brought out, or an old style being changed to perhaps meet some customer's requirements; but is not necessary in manufacturing a company's standard output.

The cost of this class of work is handled in various ways by different companies, some including it in the factory cost under the head of indirect expense and others in the cost of administration; some considering it a special item for which an appropriation is made and the cost of this work shown as a deduction from the gross profits, segregated to lines of apparatus on which the development was expended.

When our engineering and works departments are working on a new design of apparatus, we class the work as standard development, and charge the cost to an experimental order, the cost of such orders being handled as a deduction from our gross profits. After development of this kind has been completed, any sample parts that may have been made on the experimental order and that are available for stock, are shown at their factory-cost value as a credit to development and a charge to the work in progress account of the division which manufactures this particular kind of apparatus, the division taking credit in turn by delivering such parts on either customer's orders or orders for standard stock. Tools and patterns made on the experimental order and charged to development that can be used in one of the divisions of our works for regular manufacture after the development work has been completed, are credited in the same way to development at a value at which it is estimated these tools or patterns could be duplicated and are charged to the factory cost of the division's output through the indirect expense.

It will be noticed that I explain that sample parts and tools and patterns are credited to development at their value rather than at the original cost of the work. By this it will be seen that any part of the original cost of making these items that was in excess of the probable cost of doing the work after the development had been completed is not charged to the division when the latter takes over such parts, but is allowed to remain as a proper charge to development. This, of course, is logical, for if the division must have tools and patterns for regular manufacture later the same as were made in originally developing the apparatus, the division might as well buy these parts from the development account as to make duplicates of the parts already made, but the division cannot consistently be expected to pay more for such parts than it would cost to make a second set, which is the reason why the difference between the cost of making the originals and the estimated cost of duplicating them is allowed to remain as a charge to the cost of development.

Development work is also performed on manufacturing orders for apparatus, this sometimes being in the nature of new design or it may be development required to make desired changes in standard parts. When handled in this way, the cost of development, which includes engineering, drafting, tools, patterns, etc., is considered a direct charge to the order or to the cost of manufacturing the apparatus called for by the order, and is, as stated above, really a fourth step in arriving at the factory cost.

Correct Figures	Incorrect Figures	Amount Out	
$ 200.00	$ 200.00	$ 00.00	Direct material cost
350.00	300.00	50.00	Direct labor cost
$ 550.00	$ 500.00	$ 50.00	Prime or direct cost
350.00	300.00	50.00	Indirect factory expense (100% of direct labor)
$ 900.00	$ 800.00	$100.00	Factory cost
135.00	120.00	15.00	Administration and selling expense (15% of factory cost
$1035.00	$ 920.00	$115.00	Total or commercial cost
103.50	92.00	11.50	Profit (based on 10% of total cost)
$1138.50	$1012.00	$126.50	Selling price
		126.50	Actual selling price less than proper selling price
	Sold for	23.00	Less than total cost (actual loss)

HOW THE INACCURACY DEVELOPED

Administration and Selling Expense

After ascertaining the factory cost of an article it is necessary to know the total or commercial cost before the selling price can be intelligently set, and this is determined by practically the same method that is followed in arriving at the indirect expense. The total cost of administration and of the sales department in a given period, including the advertising necessary, is compared with the total factory cost of the apparatus sold during the same time, and the relation of this total administration and selling expense to the total factory cost value is taken as the percentage to be added to the factory cost of each article sold in order to get the total or commercial cost, just as a percentage of the direct labor is added to the prime cost to ascertain the factory cost.

This again is something on the "blanket" method of arriving at the cost of our output, but it is accepted as sufficiently reliable to answer our purpose, considering the expense that would be involved in getting it any other way.

Under the heading of "Administration and Selling Expense" is also included the amount paid for royalties where a company is compelled to make such payments on a part of its output. These items can be shown as a deduction from the profits of the particular line of apparatus on which the royalties are paid.

Profit

After the total cost of an article is known, the next thing, of course, is to set the "selling price." If a concern is manufacturing an article on which they have a patent, they put the selling price about as high above the cost of making the article as they please, considering only the demand for the apparatus. But the salesman's work is cut out for him when a number of concerns are manufacturing practically the same line of apparatus and the consumer can meet his requirements more or less satisfactorily by the use of almost any one of perhaps a dozen different makes of the same article; and this competition not only makes it imperative that the cost of making and selling an article be accurately known, but in deciding upon the percentage for profit to be added to this cost in setting the selling price the consumer's ability to buy elsewhere must receive more consideration than the stockholder's desire for dividends.

Conclusion

There are quite a number of methods followed in figuring costs, and even among those using the same plan there are a variety of interpretations in operating it. For instance, under this direct labor cost plan one company will include purchasing expense, storekeeping, shipping, etc., in the factory cost, while another concern will consider them as a part of the administration and selling expense, and still a third will show some of this expense in one place and the balance in the other. And so it goes, until perhaps it would not be putting it too broadly to say that each company has its own particular system and that the system in use represents the individual ideas of the management of each of these different companies.

One very objectionable feature of this condition wherein the system or at least the interpretation of the system represents the individual ideas of the management, and, therefore, probably changes with changes of management, is that to be of proper value a system of figuring costs should show a correct comparison of the costs of manufacturing an article at all different periods of a company's existence; and this cannot be if at one time certain items of expense are included in the factory cost through the indirect expense, later are considered an administration expense and still later are carried as an asset of the company.

This prompts the thought that it is very desirable, in fact I would be justified in saying that in order that a business be operated to the best interests of the stockholders and all others concerned it is absolutely necessary that a proper

cost plan be operated and very advisable that this plan be laid out as early in the life of the business as possible and continued thereafter with as few changes as possible.

Permit me, in concluding, to recall one or two examples of irregularities of cost-keeping.

The newspapers recently stated that the government had taken an inventory at one of the navy yards and found that they were over $3,000,000 short of the value that should have been on hand as shown by the costkeeping balances. The fact was not mentioned, but I can easily imagine that someone in the government accounting department was pretty much worried for an explanation of the difference. The daily papers explained a little later on that in figuring the cost of one of our new battleships an item of $3,000,000 for equipment had been omitted.

When our sales department learns that someone is in the market for apparatus manufactured by us, they endeavor to get the necessary specifications and have the cost department furnish an estimated factory cost of the apparatus to be used as a basis in bidding for the order. Sometimes when an order has been lost to one of our competitors, the sales department informs us (the cost department) that the successful bidder's selling price was about the same or perhaps less than the estimated factory cost that had been furnished by us, and it is, to say the least, very embarrassing when, after going over our figures again, we have to confess that we made an error in working up our estimated cost and that we could have made a much lower bid and still made a profit. I have in mind a case, however, where a good order was lost on account of our bid being too high but where our cost department was not to blame. Our representative was after an order, and as we have an especially good price on this particular apparatus we were considerably surprised to hear that the customer preferred our apparatus but gave the order to another concern because their price was so much under ours. Upon investigating the matter it was learned that the bid accepted was really higher than the figure furnished by us, and after running the matter down it was found that the selling price we had furnished was so low that our representative thought we were giving the factory cost price and added a percentage for selling expense and profit in submitting the bid.

One more example of the seriousness of inaccurate cost work, and I will close. Our departmentalized cost system shows separately the amount charged each division of the works for material, labor and indirect expense and the credit received for everything delivered from the division, the difference being the divisional account balance and equaling the value of the material that should be on hand; and if all the figuring by the cost department is correct an actual inventory of everything on hand in the division will agree at all times with the balance shown by the cost records, that is by the controlling account on the general books; but if the costs made up and used in crediting the division for its output are wrong, not only are the accounts wrong but the financial statements of the company show misleading figures. An inventory is taken at the close of each year and sometimes oftener, on which to base an adjustment of the book figures; and this inventory shows up any mistakes in the records. When the inventory was taken at the end of last year, while in the majority of our divisions the actual inventory and the book balances were gratifyingly close, there were others where we were unable to find in the division the value that should have been on hand as indicated by the records, and in still others we found more than was shown by the general books. This is a condition that all concerns experience (as witness the navy-yard incident), and as these differences must be handled as deductions from or additions to what the profits were supposed to have been, the importance of having correct controlling account balances will be readily appreciated.

To those giving this very important matter a fair amount of thought, it will be readily apparent the far-reaching and disastrous effect of inaccurate costs, to avoid which there must be constant vigilance on the part of those engaged in and responsible for their compilation.

The Struggle for Improvement

By Entropy

One of the hopeful signs of the times is that we are discovering how large an effort is necessary to discover the truth about things which have been accepted as simple for so many years. The work of F. W. Taylor is one of the steps in this direction. The papers presented at the December meeting of the American Society of Mechanical Engineers showed an appreciation of this fact to a marked extent.

Heretofore we have accepted the fact that a sufficiently hard tool and sufficient power would enable us to cut metals with little question as to the efficiency with which the cutting might be done. We have accepted the coreroom in a foundry as a necessary evil, and one which made necessary the production of bad smells, until Mr. Lane came forward and told us that it is both possible and desirable to pay close attention to the inside of the casting. We have accepted the filing of cores in the past as a way in which the foundryman increases the weight of our castings; but until now we hardly suspected that it might be desirable to make them to gage. The making of accurate castings may very likely become more expensive by the pound, but there can be little question as to the desirability of this method from the machinist's standpoint.

We have been accustomed in the past to seeing careful and painstaking study confined to the steam engine or other prime movers. It is a good indication that the same study is now being applied in other directions. This slowness to follow in the steps of the steam expert has, perhaps, been due to the lack of a simple unit of comparison. The whole work of the steam engineer appears to be aimed at the horsepower-hour in terms of pounds of water or coal used.

The foundryman has been concerned with the cost per pound of castings, which he could persuade the customer to accept, which has led him to concern himself about his heaviest castings rather than with his full line of work. The machinist has concerned himself with the number of pounds of chips he could produce per hour, or the number of cubic inches of metal removed, even though it was necessary to leave more stock on the forging or casting than was necessary, except for the sake of producing a record.

In order to induce men to produce results, it appears to be necessary to establish a simple method of comparison. Athletes strive to take fifths of seconds from records that have stood for years, and for practically no reward but the record. We are all striving in one way or another for a record. The spirit of rivalry is the one force that even in this mercenary age is stronger than money.

Six Year Engineering Course at Columbia

At the annual meeting of the trustees of Columbia University, recently, it was decided to extend the engineering courses to six years so as to include two years of regular academic work. Under this arrangement, after September, 1914, the engineering courses will be open only to those who have completed two years in the arts course in Columbia or some other institution of recognized standing.

According to the *Brass World*, a recent experiment in copper melting in an electric furnace produced a peculiar physiological action. Some 5000 pounds of pure electrolytic copper, were melted in a three-phase arc furnace. After a few hours all of the 10 men employed experienced difficulty in breathing. For the following 24 hours the men were attacked with a severe nausea, followed by a soreness of the entire system similar to that of acute grippe.

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Lathe Attachment for Machining Interrupted Arcs

The accompanying sketch shows an attachment to be used on a lathe for turning or boring sections of circles where it is impossible to use a continuous cut, such as the slots in cam plates, circular parts in irregular work, and other similar work.

A front elevation of the attachment is shown in Fig. 1 and Fig. 2 is an end view. On the lathe faceplate *F* is secured a crank plate *C*, the pin of which is removed from the center of the lathe spindle the required distance so as to give the stroke necessary for the surface being turned. Extending from the rear of the frame of the attachment *J* is the arm *A* which carries the bell-crank *B*, and also a quadrant on the side, carrying a train of gears, to be used when the surface being turned exceeds about one-third of the circumference. The attachment spindle is threaded on the end *S*, the same as the lathe spindle, to receive the chuck or faceplate belonging to the lathe.

To operate, place the attachment on the lathe shears and secure in position by the bolt *b*. Loosen the nut *n* on the spindle of the attachment and remove pin *P*, allowing the spindle to revolve freely. Secure the work *W* in the desired position in the ordinary way, and determine the stroke necessary for the desired operation. The collar *O* has a number of holes around its face to allow for adjustment. The pin *P* is placed in the nearest hole and further adjustment is made by lengthening or shortening the connecting rods, or shifting the crank plate *C*.

Where the surface exceeds about one-third of the circumference, the train of gears can be used giving the desired travel to the faceplate on which the work is secured.

A skeleton indication of the motion when using the bell crank *B* and crank lever *L* is shown in Fig. 3. A camplate (the cam being about one-sixth of a revolution) is shown in position on the faceplate *F*. The heavy lines show the position of the movable parts at the beginning of the stroke, and the dotted lines show the other extreme position.

A skeleton sketch of the motion, when the train of gears is being used, is depicted in Fig. 4. The portion to be machined is (roughly speaking) about 220 degrees of the circumference. With crank *C* in the former position the ratio of motion must be:

$$\frac{220}{360} : \frac{1}{6} \text{ or } \frac{11}{18} : \frac{1}{6}$$

Take a 72 gear for the spindle of the attachment: $X =$ gear on bell-crank. Then

$$X : 72 :: \tfrac{11}{18} : \tfrac{1}{6}$$

or

$$X = \frac{72 \times \frac{11}{18}}{\frac{1}{6}} = 264$$

There being no gear of 264 teeth, we must compound the train. Take 3 as a divider; then:

$$264 \div 3 = 88$$

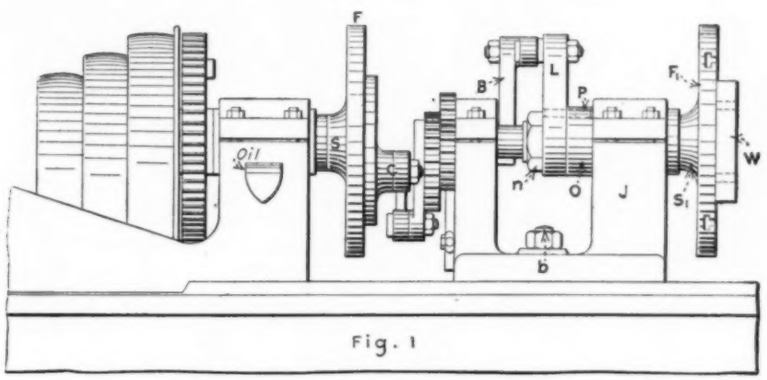


Fig. 1

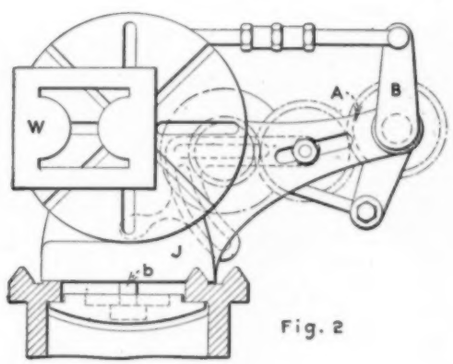


Fig. 2

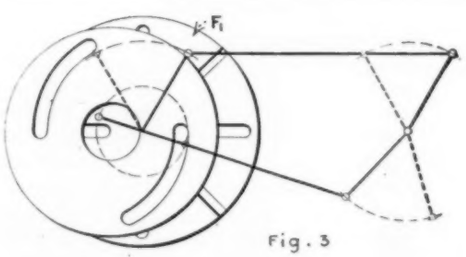


Fig. 3

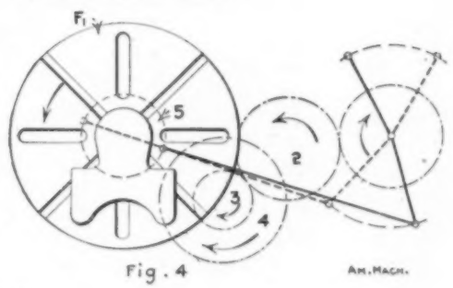


Fig. 4

AM. MACH.

LATHE ATTACHMENT FOR MACHINING ARCS

for the gear on the bell-crank; the compound gears 3 and 4 must be in the ratio of 1:3 or 30:90; then the gears necessary are

1 = 88
2 = Any intermediate gear.
3 = 30
4 = 90
5 = 72.

Proof:

$$\frac{88 \times 90}{30 \times 72} \text{ should equal } \frac{\frac{11}{18}}{\frac{1}{6}}$$

or

$$\frac{88 \times 90}{30 \times 72} \times \frac{1}{8} \times \frac{11}{11} = 0$$

If the necessary gears are not obtainable, select the nearest and adjust for stroke by shifting the crank *C*.

The pin *P* must be removed and nut *n* relieved when the gears are being used, and the quadrant lowered when the lever *L* is being used.

Hamilton, Ont. J. H. R.

Stencils for Lettering

Over forty years ago, one of my tasks in the drafting room of a ship and engine works, was to ornament my finished egg-shell paper drawings with be-au-tiful hatched and shaded decorative lettering, such as one finds on banknotes. That sort of thing is no longer tolerated; only a standard form of letter, but even a standard size, and a normal breadth of stroke.

Recently I have found in some of the largest German drafting rooms a little stencil having 18 openings, shown in the accompanying figures, by means of which all the capital letters of the alphabet, and all the numeral digits can be made correct in outline and uniform in breadth of stroke. Another style effects the same with 15 openings for the capital letters and the numerals, and a third, with 14 openings, makes all the "small" or "lower case" letters. The stencil is slid along a ruler or its equivalent, to keep the line straight; all the skill requisite being to hold the pen vertical, and not to set the stencil on undried strokes. I inclose an example of what the stencil looks like, and how it is used. The solid lines are to be followed, and the dotted ones skipped, to produce the different letters.

FIG. 1. THE STENCIL FOR CAPITALS

FIG. 2. THE STENCIL FOR THE SMALL LETTERS

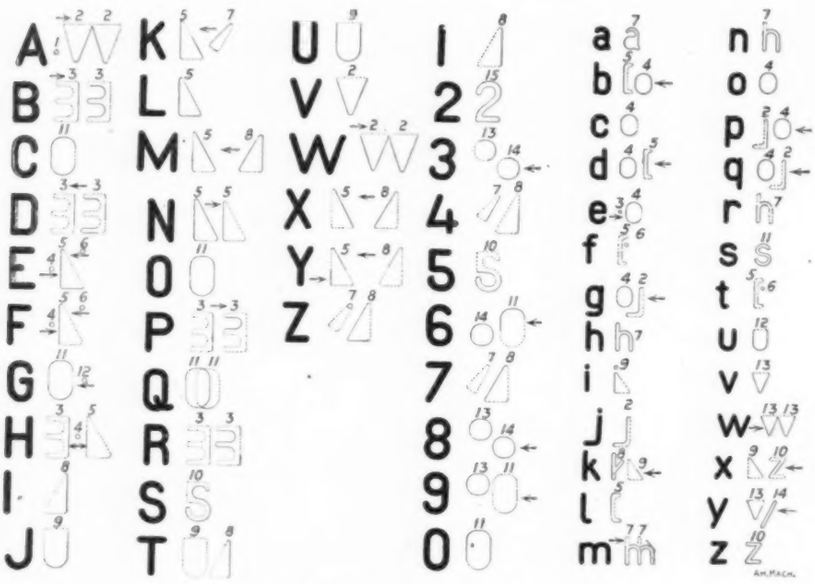


FIG. 3. HOW THE LETTERS ARE DRAWN

ROBERT GRIMSHAW.

Dresden, Germany.

principally because it costs money, even where the budding draftsman is a volunteer or apprentice on nothing a week the first week, and double that in the second quarter.

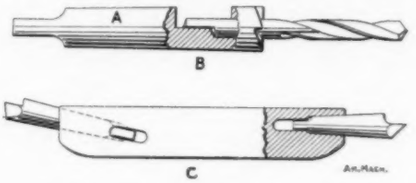
Nowadays architects and patent attorneys affect crazy so called medieval lettering, which sometimes can be read two different ways, and sometimes not at all. It is refreshing to know that the movement started not many years ago by the Westinghouse companies and some others, to use the fewest strokes possible in lettering, has been followed by a great many other important establishments; many of which demand not

Utilizing Taper Shanks of Broken Twist Drills

The sketches submitted herewith show how to utilize the tool-steel taper shanks of broken or used-up twist drills.

In the illustration *A* shows a taper shank with central hole drilled to fit any size straight-shank drills. A slot, as shown, is milled across and close to, or exactly to, the center of the hole. If one-half of the shank of the drill is cut away as shown at *B*, when it is inserted in the hole, the half projecting over the bottom of the slotted portion forms a strong drive for the drill. This is a very old device but it is surprising how few of our younger mechanics are familiar with it. The end of the shank may have teeth filed in it, thus becoming a handy counterbore.

A holder for lathe tools is shown at *C*. Each end has a taper hole and slot like



HOW THE SHANKS ARE USED

that used in the ordinary socket. The axial line of the hole at one end is parallel to the bottom of the holder. A broken taper shank can be inserted in this hole and the end ground for a side cutting or other form of lathe tool. The opposite end of the holder has the taper hole at an angle to the bottom line of the holder, and this projecting end of the taper shank is ground like a diamond point.

These illustrations may suggest to your readers other ways of utilizing the taper shanks of twist drills which are made of an excellent quality of tool steel, and which it is a shame to throw away. The tools from which these sketches were made were called to our attention by David H. Shattuck, of Graniteville, Mass.

J. D. COX, PRESIDENT,
The Cleveland Twist Drill Co.
Cleveland, Ohio.

From figures prepared by the Bureau of Statistics the 250 million dollars worth of iron and steel and 35 million dollars worth of agricultural implements exported from the United States last year found markets in practically every part of the civilized world. Steam locomotives and steel rails went largely to Canada, Mexico, Brazil, Argentina and Japan, where the rapid development of railways enabled an increased absorption of those materials from this country. Structural iron and steel of American manufacture is being utilized in increasing quantities by most of the leading countries of North America, as well as in Australia and Japan. The farms of Canada, Argentina, Brazil, Australia and New Zealand are requiring increasing quantities of American wire. Our sales of electrical machinery show a healthy expansion in such important markets as the United Kingdom and other European countries, as well as the newer communities of the western hemisphere. The same might be said of sewing machines and metal-working machinery.

Discussion of Previous Question

Referring to letters and articles previously published

Cutting a Screw of Variable Pitch

Under the above heading, on page 655, Vol. 35, C. F. Smith gave us an interesting account of how he rigged up a lathe to cut a variable-pitch screw, but unfortunately for the uninitiated he was somewhat vague about the cam he used, and worse still, the cam development shown was so small, that it appeared to have straight lines, and this may mislead, because straight lines would drop the pitch without varying it.

The problem presented by Mr. Smith has had experience with two methods of producing them; one by practically the same method as described by Mr. Smith, and the other also on the lathe, by using a cam shaped as shown in Fig. 2.

As the method of laying out cams for this sort of work was not given perhaps a short description will be in order.

Let us assume that the lathe is geared up to cut ½-inch pitch and that it is required to cut 10 threads of variable pitch finishing with 4 threads of $\frac{5}{16}$-inch pitch. It is clear that since we are to drop from ½-inch pitch to $\frac{5}{16}$-inch pitch in 10 threads (the lathe being geared up for ½-inch pitch) then the first thread of the variable portion will have a pitch of:

$$[\tfrac{1}{2} - (\tfrac{5}{16} \times \tfrac{1}{10})] = 0.48125 \textit{ inch}$$

and the pitch of the second thread will be:

$$[\tfrac{1}{2} - (\tfrac{2}{16} \times \tfrac{2}{10})]$$

and so on.

Now these corrections are accumulative so that our cam measurements taken from a datum line will be: x; $3x$; $6x$; $10x$; $15x$; $21x$; $28x$; $36x$; $45x$ and $55x$ respectively; where x is equal to the drop in pitch of our first variable thread. For the four-end threads it is obvious that since a constant pitch of $\frac{5}{16}$ inch is required, the cam must give a constant decrease of $\frac{5}{16}$ inch per unit of cam travel; units being in terms of lathe-spindle revolutions, and are represented on the cam development, Fig. 1, by the horizontal lines.

The datum line, on this figure, is supposed to pass through the center of the rollers when cutting ½-inch pitch, but is moved outward for convenience and the development is shortened to show the variation in width of the cam rib which takes place or is brought about, by reason of using a relatively small angular cam movement.

The method of constructing the cam shown in Fig. 2 is to work from a datum circle and lay off the distances, as defined for Fig. 1, along the radiating lines, these lines representing lathe revolutions.

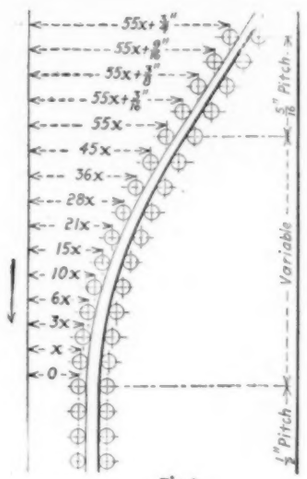


Fig. 1

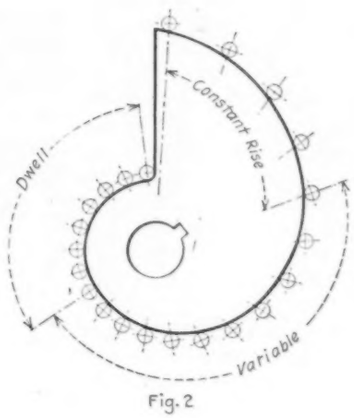
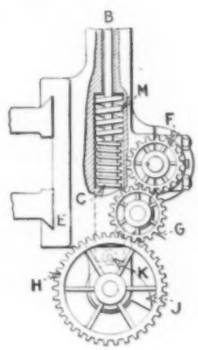


Fig. 2



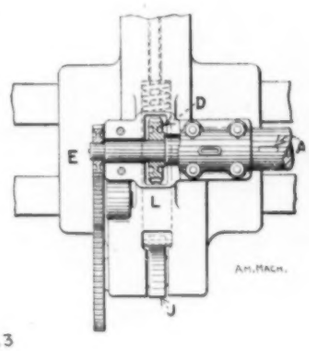


Fig. 3

CUTTING A SCREW OF VARIABLE PITCH

was to cut a screw having ½-inch pitch at one end and $\frac{5}{16}$-inch pitch at the other, the intermediate portion varying from the pitch at one end to that on the other end.

He says: "For several turns the screw was cut as geared up, then it was retarded $\frac{1}{16}$ *of an inch* while making the required number of turns to reach the point where the pitch was to be $\frac{5}{16}$ inch;"

. . . .

The retardation of $\frac{1}{16}$ inch, as given by Mr. Smith, is an error, as the cam must give that if there is only one variable thread. Cams to do work of this description must have an increasing rise, that is, they have a curved outline in the development, and this is pointed out because the writer once saw a mistake made on a similar cam, which goes to show that the principles are not well understood.

Variable-pitch screws are fairly common on textile machinery and the writer

This cam was used to pull the lathe lead screw back and was geared up to the lathe spindle by means of the back shaft.

Today there is a machine on the market using this principle and a cam similar to Fig. 2, for milling a variable twist on twist drills.

A diagrammatic sketch of the essential parts of the Biernatzki twist-drill fluting machine is shown in Fig. 3.

In this machine the socket *A*, carrying the drill, is rotated by means of shaft *B* through left-hand worm *C* and worm wheel *D* as the table *E* is fed forward. Socket *A* is also connected through the gears *F G H* to cam *J*. A strong spiral spring *M* forces the worm *C* up against roller carrier *L* and this pressure, together with the resistance of the cut, keeps the cam roller *K* in contact with the cam; consequently, as the drill is fed forward, the worm loses ground, owing to the cam retiring, and the lead of the

drill flute is constantly lengthening toward the shank.

By the way, why don't the makers of twist-drill fluting machines equip their larger machines for cutting spiral-slab milling cutters? At the suggestion of a superior, the writer fitted a Biernatzki machine with a dividing arrangement on the back shaft, and found, apart from the extra time required to set up over the setting time on the universal mill, that it did the work in fine style.

WALTER G. GROOCOCK.

Woolwich, England.

Cost of the Special Order Not so Wasteful

The statements by C. J. Morrison in Vol. 35, page 1174, that the special order is the "bane and terror of many concerns," a "menace to business" and that the "manufacturers should take a firm stand and drive the undesirable to the wall," is indeed putting the case strongly, and some many think, radically.

There are, no doubt, instances where a special order has interfered with the regular routine work to quite an extent and ultimately landed in the junk pile, but this is the rare exception and not the rule. Even the experience thus gained has been put to good account by both builder and customer.

The American people pride themselves on their progressiveness, and if we are to close the manufacturing plants to all work save that which today is considered standard, we may soon expect to find ourselves bringing up at the rear in the march of progress.

The standard machine of today was the special order of yesterday, and was made the standard because some "insurgent" conceived a better method of producing results. Furthermore, he was willing to spend money and energy with an equally credulous and progressive manufacturer in producing a machine whose performance placed it a step in advance of the standard machine as a money maker.

By all means let us have standardization in all machine building, so far as it may be consistent with the best practice of the day, but such standards should not be so unflexible as to admit of no modification as occasions arise.

Perhaps the most comprehensive and well received contribution to the subject of standardization in its many applications, was incorporated recently in Mr. Alford's address on the "Standardization of Machine Tools," delivered before the meeting of the Machine Tool Builders. In the beginning he said:

> I doubt if any one of you questions the proposition that much can be done along the line suggested by my title to the immediate advantage of the purchaser and user of machines. At the same time nothing can be tolerated that will tend to hinder development: First, of the machines broadly, and second, of a given machine as an individual.

It does not take a broad stretch of the imagination to recognize in the above a regard for the special order which usually precedes any modification of existing standards. In adhering strictly to the manufacture of standard machines and parts, we do not escape the occasional mistakes and certain amount of spoiled work, which Mr. Morrison assumes as accompanying most all special orders.

In outlining the administrative "Problem of a Typewriter Works," in which the work is almost wholly of a repetition nature, a manager writing recently in the AMERICAN MACHINIST takes cognizance of this natural detriment (a certain amount of spoiled work) and receives reports from his inspection department "on all missing and spoiled work, assigning responsibility whenever possible, and the cash value of the losses."

UNDER CERTAIN CONDITIONS IT IS BENEFICIAL

Except in rush times, most plants are so equipped as to permit the acceptance of an occasional special order, the customer realizing full well that such an order must necessarily come through slowly. I have seen the results of the special order from both angles, and this is the resulting impression: As regards the builder, an idle machine tool means idle money, and a great many manufacturers just at this time would welcome a few special orders to keep this money at work. It adds spice to the otherwise monotonous production of the standard machine, the workmen are all anxious to have a hand in its making and the new ideas suggested have a broadening influence.

The customer has the satisfaction of knowing to a certainty whether his ideas are an improvement over existing standards. If the customer is wise he will give such work into the hands of a reputable concern, and both parties anticipating such contingencies as might arise to retard the work will make due allowance in entering into any contract for construction.

To establish and maintain a reputation for accuracy in detail in building a special order, in addition to the regular line, is a valuable asset and has a stabilizing rather than disturbing effect upon the business as a whole.

In view of the fact that the acceptance of special orders has not heretofore been the result of purely altruistic motives, but has been indeed a paying proposition to the builder, it hardly seems probable that the "undesirable" will very soon be "driven to the wall," as in it is recognized not only a source of revenue, but, as has often been the case, it has proved the precursor of better methods and of improved standards.

H. R. GILLIAM.

Zanesville, Ohio.

Is Oil Tempering Reliable?

On page 923, Volume 35, H. S. Davis asks if the oil tempering furnace is reliable. Now I have used the oil furnace for tempering for several years and have never known it to be anything but reliable; it therefore, seems to me that there is something wrong somewhere, as I cannot understand why Mr. Davis encounters the difficulties which he relates.

From my experience with the oil furnace it does not matter whether a man uses tallow, lard, cylinder or any other oil; if he heats it to 560 degrees F. twice a day for 30 days he gets precisely the same temperature the last time as he did the first, and it has precisely the same effect on the steel to be tempered, unless he uses an inaccurate and fluctuating thermometer, in which case, during a 30-day period he would, of course, get different results.

I have found out this much, however, the longer the oil is used the thicker it gets, and I think this is accounted for somewhat by putting tools that have been taken out of boiling water directly into the oil while wet. I also know that the flashing point is lowered every time the oil is used, so that if a man persists in using it after it becomes very thick, he is running a chance of having a burning oil furnace on his hands. Great care must be taken to let the tools into the oil when they are wet, especially if the oil is 300 degrees F. or over.

My furnace holds 12 gallons of oil and I handle approximately 500 tools a day. Three times a week I run a heat in the morning and also a heat every afternoon. The heat in the morning is composed of dies, punches, undercut blades, reamers, forming tools, but mostly taps; the heat for the afternoon is composed of almost every kind of tool, from a fine undercut blade to a batch of cold chisels, and all are placed in a basket in the proper position to be taken out at the proper temperature one after the other. The only thing that I notice is the thickening of the oil and lowering of flashing point a point that can be easily determined by the amount of smoke given off by the oil.

I cannot tell exactly how long the oil lasts, as I neglected to make a note of it when changing the oil several times during the past year, but I should say about 42 days, which I believe is getting about as much business out of 12 gallons of oil as possible.

I have made tests and used the scleroscope on tools, tempered with the first heating of the oil and again after the oil had been used to its limit, the tools being the same kind and made from the same bar of steel, hardened at the same temperature and I have failed to notice any difference in temper. I use German cylinder oil.

Decatur, Ill. GEO. COLES.

Pulleys for High-Speed Belts

In reading the interesting article on the above subject by Karl W. Knorr, in Volume 35, page 1024, I notice that he gives a constant in the formula for the tension in belts due to centrifugal force which is apt to be very misleading in actual practice, namely, the value 0.012. The formula $T = 0.012V^2$ is obtained from the formula

$$T = \frac{W V^2}{g}$$

where W is the weight of 1 ft. of belt, 1 square inch in section, and g is 32.2. While Kent gives a value for W of 0.388, I have found this value for belts that have been in use for a little while to be as high as 0.5, with a probable average value of 0.45; hence the constant may be as high as 0.0155 for leather belts.

Although centrifugal tension is the cause of most of the actual slippage of high-speed belts, it is interesting to note that it is practically impossible to have no "creep." This is very clearly shown in Prof. Goodman's "Mechanics Applied to Engineering," for the reason that the belt on the tight side of the pulley is under a greater tension than when it leaves the pulley. Hence the driving pulley receives a greater length of belt than it delivers on the slack side, and this contraction of the belt as it goes around the driving pulley must result in slip or "creep," which in ordinary practice may easily amount to 2½ per cent.

It is frequently said that it is impossible to calculate with any degree of accuracy the proper diameters of pulleys to obtain a certain speed ratio, where this ratio is high, because the amount of slip is unknown. I have frequently found that those making the statement do not apply the rule of adding to the diameter of the pulleys one thickness of the belt. Here is an example showing how important this may be:

Take the example of a blower in a smithy driven from the lineshaft of the neighboring machine shop: r.p.m. of lineshaft, 200; desired speed of blower 2900 r.p.m. Calculated without adding the thickness of the belts, it is found that driving from a 32-in. to a 12-in. pulley on a countershaft and thence from a 38-in. to a 7-in. pulley, 2895 r.p.m will be obtained

$$200 \times \frac{32}{12} \times \frac{38}{7} = 2897$$

Taking into account, however, the thickness of the belts (8-in. 2-ply and 5-in. 1-ply)

$$200 \times \frac{32.32}{12.32} \times \frac{38.2}{7.2} = 2782$$

Thus, there is an error of 3.9 per cent.

To avoid this error, make an allowance for the unavoidable "creep" due to the difference in tension on the belt on the two sides of the pulley and calculate the slippage due to centrifugal force; then if desired the correct diameters of pulleys for high speeds can be found exactly.

A. W. PURCHASE.

Oilfields, Calif.

Lathe Tools

Mr. Herford illustrates an interesting lathe tool on page 989, Vol. 35, and one which I should expect to give splendid results for roughing cast iron with coarse feeds. There are, however, certain limitations in our work which make the Lodge & Shipley form of tool, shown on page 463, better suited to our conditions.

Castings which have a considerable amount of stock to be removed in the lathe are often so massive that they will not spring under coarse feeds. In such cases, a maximum amount of stock can be removed for a given power consumption by using a relatively coarse feed, even though the surface speed must be somewhat reduced as the feed is increased. Mr. Herford's tool, because of its broad, straight following edge, would leave a smoother finish on the work than would a round-nose tool with a sharper point.

On the other hand, a broad following edge increases the tendency to chatter, which would make its use undesirable in some cases. Often the spring of the work itself renders a coarse feed impracticable, so that a comparatively smooth rough-turned surface is obtained without the use of a broad following edge.

One most important consideration in determining the shape of a cutting edge for our roughing tools is to leave a shoulder on the work, which can easily be squared. That is, the cutting edge of the lathe tool should be at right angles to the axis of rotation of the work. Most of our lathe jobs are shafts or studs having different diameters requiring squared shoulders. A tool with cutting edge at 60 deg. to the axis of the work would leave an excessive amount of stock at each shoulder to be removed by the squaring tool.

From my understanding of Mr. Herford's tool I cannot see that it is more economical as regards forging and grinding than ours. His top rake is made up of just as much back slope as of side slope. A great angle of top rake, such as he suggests, would eat into the body of his tool after a few grindings on the top face. In our tool the top rake is secured principally by the side slope, which does not grind into the body of the tool to so great an extent; the back slope is kept comparatively small. For these reasons I am sure that our tool would stand more grindings than his without reforging.

Mr. Herford's point is well taken as to the desirability of placing the tool support far forward; that is, as nearly under the cutting edge as possible. My sketch was incorrect in this particular, because, as a matter of fact, the body of the tool beneath the cutting point is not rounded off, as shown in the sketch.

The degree of top rake, whichever the style of tool used, can, of course, be made to best suit the conditions under which it is used. I have had better results in using a somewhat greater degree of top rake on soft steel than on ordinary cast iron. An authority on this question bears out this experience rather than Mr Herford's. I refer to "The Art of Cutting Metals," by F. W. Taylor.

To sum up, I consider Mr. Herford's tool preferable for certain special cases only; on the other hand, our type was only submitted as a suggestion for a general-purpose tool. For general roughing requirements on miscellaneous lathe work, I would prefer our type.

Cincinnati, Ohio. H. M. WOOD.

Concerning Modern Apprentices

On page 1189, Volume 36, you have an editorial on the "Modern Apprentice," and we are very much pleased to find you giving this important item such prominence, especially at this particular time. You state that some competent instructor should look after the apprentices. This works out well in the larger plants, but as the majority is not of sufficient size to warrant an instructor, the superintendent and foreman now have more time to instruct these apprentices than they would have if business were crowding them.

We believe it would be a very good thing to bring home to all manufacturers that now is the time to put on these apprentices and give them the proper instruction, so as to provide the right kind of mechanics when the rushing business comes to us again.

There is one paragraph to which we want to take exception, and that is, that the apprentices work under a definite agreement for a term of years at fixed wages. We believe that it is certainly wrong to say that an apprentice should work at a fixed rate, especially when we are fighting this thing on all sides in regard to journeymen. If you will contrast a boy of 17 coming into a shop, without previous experience, whose father is probably in a business entirely foreign to this, and having only a fair school education, with another boy probably 18 years of age, with a good education, a much stronger constitution, and whose father and brothers are probably employed in the machinery trade, so that the boy is more or less familiar with shop language, etc., you will readily see that the latter has not nearly so much to learn as the first boy.

Now just think of these boys starting in both at eight or ten cents per hour, and then stop to consider whether it is justice to pay them the same rate at the end of one year's time. We certainly believe that this would be an injustice, and is probably one of the causes why so many more of the young men go into other trades. While we believe that the boys should start in at the same rate, so as to try them out, their rate should be increased according to their efficiency at the end of a six months' trial.

GEORGE LANGEN,
Supt., the Cincinnati Planer Co.
Cincinnati, Ohio.

An Assembling Fixture for Type Bar and Pivot

Under the above heading, on page 1035, Vol. 35, there appeared an article by Harold Lamb, Chicago, Ill., criticizing my previous article on this subject and seeming to have doubts as to the fixture working as intended; that is, economically.

The description of the working of this device in the former article was not as complete at it might have been, but as the drawing, before shown, was clear, if reference be had to it, I will again give an explanation of its workings, which should satisfy anyone as to its utility.

The tool is mounted in a standard pillar subpress, such as is used on foot presses in this factory. The lower die is almost identical in design to one that had been satisfactorily used for 15 years for the same purpose. The magazine feature was added to the upper die to enable the operator to get an increased output, which object it accomplished. The pivots are scooped out of an open-end box, with a funnel-shaped scoop which is suitably pointed to guide the pivots into the magazine without any handling of individual pivots by the operator.

In operating the fixture the foot-press operator gives the treadle a kick, bringing the dies together and releasing a pivot, which drops into the hole. At the same time he picks up a type-bar and places it in position, and again operating the treadle, presses the pivot home. He then removes the assembled part and picks up another bar, at the same time using his foot to operate the press again, dropping another pivot in the hole, and so on.

It is true, as pointed out by Mr. Lamb, that the stud *O* releases the spring *P* on every stroke, but when a type-bar is in the fixture the pivot, which has just been pressed home, protrudes up into the upper die or punch a sufficient distance to prevent the next pivot in the magazine from getting beyond control of the plunger operated by spring *P*, until the stud *O* ceases to act, thereby precluding the possibility of the pivot leaving the magazine on a working stroke.

This design might, perhaps, be improved upon, but it is a cheap fixture, which does the required work satisfactorily, and increases the output greatly, and, being used in a piece-work shop, it is no hardship for the operator to make two movements with his foot when his output is increased thereby.

If Mr. Lamb could see this fixture in operation, I believe he would, in his designs, attempt to use all the foot-motion possibilities available.

Chicago, Ill. D. A. CHARLES.

Elimination of Dashes on Drawings

In Volume 36, page 34, of the AMERICAN MACHINIST you publish a communication from Arthur N. Patterson under the heading, "Arrowheads on Drawings." Permit me to say that I am heartily in accord with Mr. Patterson on these lines. Arrowheads at ends of dimension-lines should never be omitted on any drawing, as such practice would be the cause of most serious mistakes. Similarly the elimination of inch or foot marks after numerals would prove a fatal blunder.

If a saving in time, and incidentally money, is to be effected, why not do away altogether with the dashes between the feet and inches in dimensioning? They have been used as long as I can remembeb, yet the blank space alone instead of the customary dash would serve the same purpose, i.e., separate the two values.

Concerning "border lines" mentioned on the same page I would say, that a simple border line around a drawing will not perceptibly add to the cost and will materially enhance its appearance. Of course, fancy borders and especially the corner designs which we occasionally see in our textbooks on mechanical drawings, should never be considered.

C. W. REINHARDT.
New York City, N. Y.

Repairing a Crankshaft

Referring to the letter of F. W. Brady, at page 1135, Vol. 35, illustrating a broken crankshaft, and giving his experience with welding and brazing companies:

To answer his question directly, there is no question that this shaft can be satisfactorily repaired by the autogenous process. As the break is in the web, it can be reinforced quite easily and the bearing will not be affected to any extent. The chances are that it will be distorted slightly, but a machinist could easily straighten it in an hour, or two at the most. The total of welding and machining would not exceed ten dollars in any first-class shop in this section, and the chances are that it would be several dollars less than this amount.

The communication of Mr. Brady is interesting. Over half the trouble today with the welding game is that the user cannot, or will not, understand the difference between good and bad welding. No operator should touch a steel repair job unless he is most expert. It requires something more than a flame of 6300 deg. to put steel together in a proper manner, and that something is intelligence and long experience.

There are many kinds of crankshafts, and I am sure that Mr. Brady would not think of calling up a machinery supply house and asking how much a lathe costs. In order to intelligently quote prices, it is necessary to see either the article itself or a sketch. Naturally, Mr. Brady secured a lower quotation on brazing this shaft than on welding. The preparation required in brazing a job of this character in much less than in welding it. There would be absolutely no chance of its holding by brazing, unless it was reinforced by straps.

Mr. Brady comes to his summary much sooner than he should. This shaft can be welded to insure strength, alignment and full size of all the parts, but it must be done in a well equipped shop by competent men. It is advisable that mechanics, generally, should get acquainted with this process, in order to be able to intelligently describe a break and thoroughly understand how it is going to be repaired.

Get acquainted with the right kind of a shop, talk with the proprietor and find out his methods and his ideas of doing work. Learn the difference between welding on a boss on a heavy casting and welding a crack in that same casting, and why it costs more money to weld the casting itself than it does to weld on a lug or an arm.

M. KEITH DUNHAM.
Boston, Mass.

Improvement in the Crowbar Opening

In connection with the article in Vol. 35, page 1159, entitled "Crowbar Opening on Machine Tools," anyone who has had to handle and place machines will heartily endorse the suggestion of the crowbar openings on the base.

There is just one little improvement which could be made. The upper side of the pocket should be parallel with the base of the machine, instead of on an angle, as shown in your illustration. By so doing, you could use a wagon jack, or a toe on a railway jack, in addition to the crowbar, but as it is now, the toe of the jack would slip out.

Galt, Can. J. A. MCEWAN.

To remove the gummed grease on the polished parts of machine tools, use alcohol which will clean it perfectly.

Selective Hardening and Carbonizing

Special Correspondence

A fire-paint which is impervious to the action of carbon, thus permitting the isolation of carburization. It regulates also the rate of chilling in the hardening of carbon steels, producing effects different from oil or water quenching and opens up a series of new possibilities in the heat treatment of steel.

In the quenching of properly heated steel in water or oil, usually two definite chemical structures are formed. They are martensite and sorbite, or in simpler terms, glass-hard and partially hard steel. The formation of martensite is always accompanied by the generation of needle-like crystals and a readjustment of the molecules, setting up enormous stresses unless the piece is thin enough to be free to warp.

In the formation of sorbite, there is less chemical change, consequently there is little or no stress developed which may cause warping. This has long been known, and has given birth to the idea that if steel could be hardened without the usual preliminary formation of a useless high hardness which usually has to be reduced by reheating, such would be the ideal method, for then the warping and cracking which always made tool making uncertain work would be eliminated.

The process of reheating to let down the temper is easy and very desirable because with it the final temper is under perfect control. Therefore the only advantage there would be in simultaneous hardening and tempering would be the elimination of warping.

Many things are now hardened in oil for this reason, but the results are usually not satisfactory. Oil, like water, will form martensite, but since the rate of chilling is so slow, the internal heat will constantly attack and draw temper about as fast as the hardening goes on if the piece has considerable thickness. If the parts are thin they become glass-hard in oil the same as in water and warping must be expected. Where it is desired to have the parts glass-hard there is no method—no matter how careful and uniform the heat treatment and quenching—which will prevent warping absolutely.

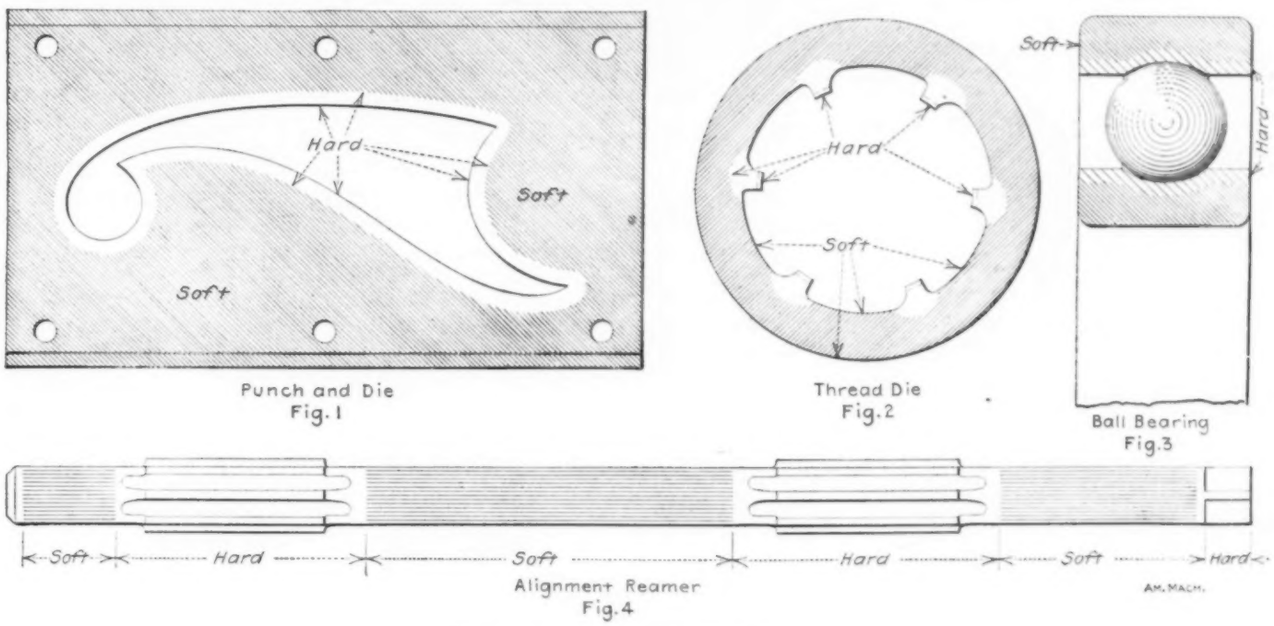
When, however, it is desired to bring out only partial hardness with the idea of eliminating warping, the following method devised by Albert F. Shore, of the Shore Instrument & Manufacturing Co., New York, will produce the desired results in two ways:

Partial Hardness without Warping

First: By covering the steel while cold with a fire paint. This fuses at the usual hardening temperatures and clings to the steel while quenching is going on, thus regulating the rate of chill according to the thickness with which the paint has been applied. When the chilling has progressed enough, which by the way, is somewhere near the boiling point of water, this coating will be blown off by the action of the steam, leaving the tool perfectly clean and white. In this manner the formation of martensite, as in oil quenching, is absolutely avoided; even though the desired hardness is obtained, there will be no warping.

Second: By allowing only certain parts of the edges of the tool to harden outright, while the body thereof, which has previously been coated with the fire paint, will come out soft enough to machine (about 40 hard) or have a hardness equal to a spring temper (about 60 hard or over, by the scleroscope).

To obtain this result the whole piece is quenched in cold water and warping is avoided by the opposition of the larger mass to the warping tendencies of the smaller mass. This is shown in Figs. 1, 2, 3. In these instances the temper on the extremely hard parts can, of course, be drawn the same as usual. Other instances where this method of local hardening produces the most satisfactory results are shown in Figs. 4, 5, 6, 7, where only the cutting or working surfaces are hardened while other parts are only toughened to resist stresses. There is no opposition offered in this instance by the part being hardened outright, and the work, of course, is not so liable to distortion.



Examples of Selective Hardening

Hardening Chrome Nickel Steels

Alloy steels which are sensitive and which for this reason, now have to be hardened in oil with uncertain results,

can by this method safely be hardened in water.

It is frequently necessary to make a pinion as an integral part of a shaft. The pinion must be hardened while the shaft usually is left soft to avoid the extraordinary warping, common in this steel, and which would practically spoil the job even though it could be ground true, for as will readily be seen, while the shaft may be ground true, the gear could not be ground and would, therefore, remain out of true. The same often holds good in studs and other parts which require one or more parts hard, to resist wear, and the other part soft enough to resist shock. This method is particularly advantageous where alloy steel gears of considerable size are used and which are sure to lose their accuracy in the hardening, even in oil.

By coating all the parts which need not be hardened with the resisting material, a somewhat lower carbon, which will warp less can be used, making up for the lesser hardening properties when quenched in water instead of oil as now. It will be understood here that the principal reason why the alloy steels warp and crack more than carbon tool steel is because they harden by comparison very deep.

Selective Case-Hardening

A modification of the fire paint used for selective tool or alloy steel hardening has made it possible to replace the copper plating process now used for selective case-hardening. This method works well considering the extreme difficulty under which any compound of this kind must work, as heated vapors of carbon monoxide have not only the property of breaking down most of the chemical compounds which are able to resist heat, but are so subtle that unless the copper plating referred to is perfectly done, the heat will go through this also. A worm and gear carbonized only on the wearing surfaces to escape the warping tendencies which would exist if the whole part were carbonized and quenched is shown in Fig. 8.

The dividing line between the carbonized and uncarbonized parts is practically as well defined as printing on paper, consequently the most accurate results can be obtained. A line drawn with a small brush on soft steel will, after hours of exposure to heat and carburization retain its configuration and when removed, will show a streak of uncarbonized steel. When quenched in water, it will be found that while the piece in general will harden outright, the uncarbonized line will be absolutely unaffected and dead soft.

Fig. 10. Die Coated and Ready to Heat

There are many machine parts which can be thus hardened in some parts and left soft in others by merely dipping into or applying with a brush, the protective coating, see Fig. 9. The coating dries in about half an hour. It is then ready for the furnace. After carbonizing to the required depth on the exposed surfaces, the parts are annealed in the usual way. By then reheating and quenching to harden, the fire paint will be removed or broken up by the shock of the chill. It is so constituted that when it is used on interior surfaces, as bushings, screw threads, etc., where it cannot drop off it can be dissolved by boiling in hot water for an hour or two. It is still better to use a little caustic potash or soda in the water, as this will hasten the dissolution.

This method is also very advantageous in instances where the carbon in case-hardening steel is too high, but yet too low to permit direct hardening, for in the quenching, the paint will cling until it is nearly cooled and thus aid in keeping the soft parts softer than they would be if exposed to sudden chilling. The same results may, of course, be obtained by using the compound recommended for tool steel. Fig. 10 shows a steel die coated with the fire-resisting paint, ready to heat.

Imports into the United States for the 11 months ending with Nov., 1911, were valued at 1392½ million dollars, against 1426 million in the corresponding months of 1910. Of this total of 1392½ million dollars worth of imports, 324½ were manufactures ready for use, against 344½ million in the same months of last year, a fall of 20 million dollars. The decrease occurred chiefly in manufactures of iron and steel, manufactures of wood and manufactures of silk.

Fig. 5 Mandrel

Fig. 6 Slender Mill

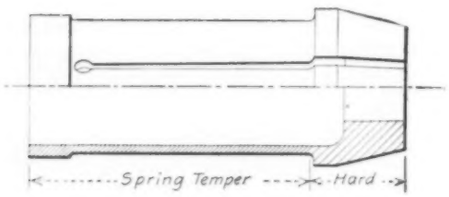


Fig. 7

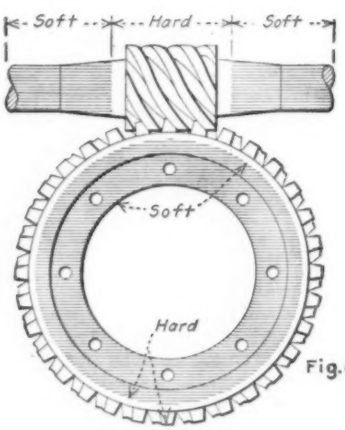


Fig. 8

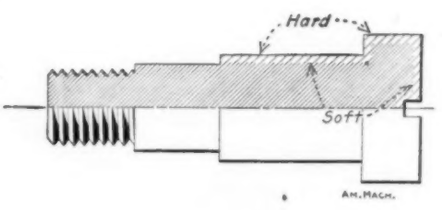


Fig. 9.

Examples of Selective Hardening

Knurling in the Screw Machine

By S. Nevin Bacon

Knurl holders for use on the cross-slide of an automatic for various kinds of work, shown and described in detail.

The subject of knurls is unintentionally slighted by the technical papers, possibly because a knurl is considered only a simple roll and understood by all. But the methods of holding knurl rollers, especially in screw-machine work, have led to the designing of many interesting tools, and oftentimes knurling is done as a separate operation on a hand machine because the proper method of holding the roll was not thoroughly tried out. It is intended to describe in this article various methods of knurling as applied in different factories.

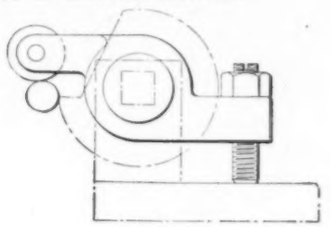


Fig. 1
For $\frac{3}{8}$" Cleveland

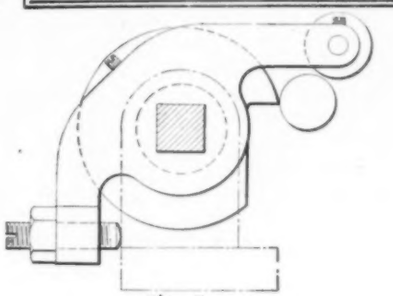


Fig. 3
For $\frac{5}{8}$" Cleveland

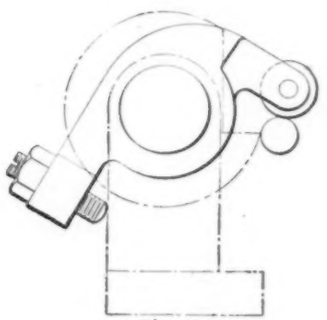


Fig. 2
For $\frac{5}{8}$" Cleveland

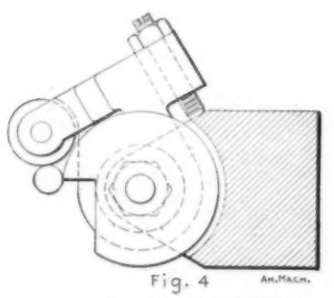


Fig. 4
For 00 – Brown & Sharpe

CROSS-SLIDE KNURLS FOR AUTOMATIC SCREW MACHINE

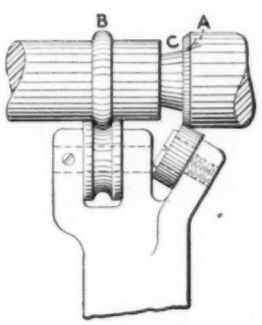


FIG. 5

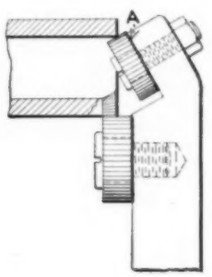


FIG. 6

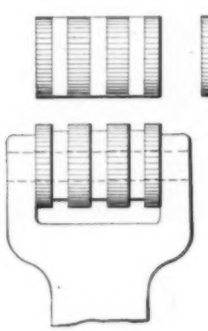
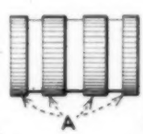


FIG. 7



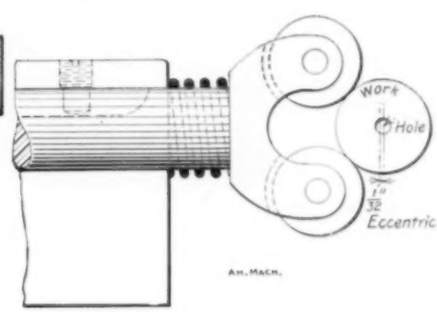


FIG. 8

CROSS-SLIDE KNURLS FOR AUTOMATIC SCREW MACHINE

There are various methods of mounting cross-slide knurls on the Cleveland automatic screw machines, but those shown in Figs. 1, 2 and 3 have proved to give the best results. Figs. 2 and 3 are used on the same size machine. A design of knurl for the Brown & Sharpe automatic screw machines is shown in Fig. 4.

SOME SPECIAL KNURLING TOOLS

Some special knurling tools are shown in Figs. 5 to 13 which when slightly altered will be found available for use on the lathe, and hand and automatic screw machines. The double knurl shown in Fig. 5 saved money for the firm that devised it because the end *A* had previously been finished is a second operation. At *B* is shown a formed knurl roller. The holder is made up as a forging. Before knurling *A* the cutoff tool is advanced to cut in at *C* so that a corner is produced against which to knurl.

Another double knurl is shown by Fig. 6. On this one the rolls are mounted one ahead of the other, and the stock is fed against a special stop after the roller *A* is in place, thus allowing it to enter the hole which has just been bored. A feature of this tool is the provision for simultaneous inside and outside knurling.

These special knurls are often made when not required. Take for instance the very wide knurl shown in Fig. 7. Such a wide tool carrying four rollers was unnecessary and was soon displaced by the better method of forming grooves in the work shown at *A* and then knurling from the turret.

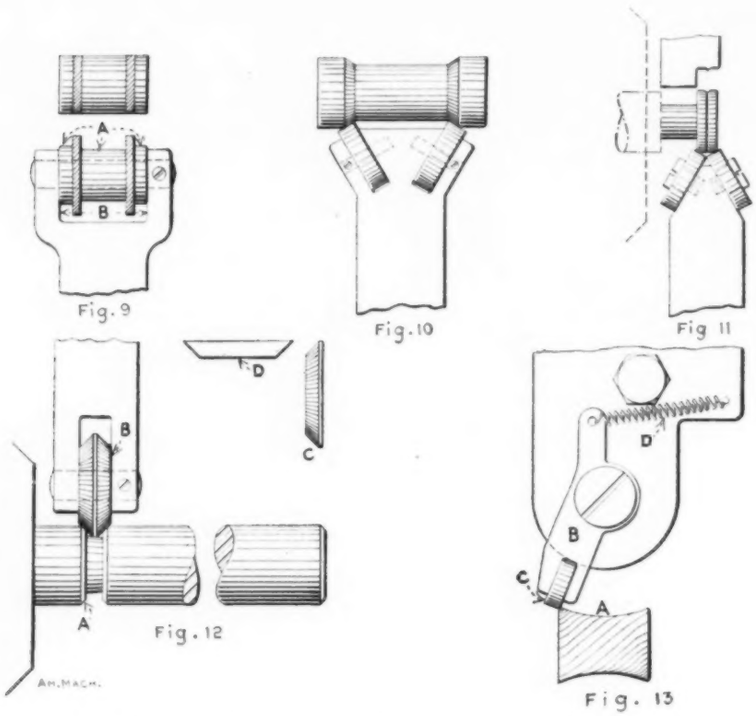
A cross-slide knurl used for eccentric work is shown in Fig. 8. This tool might be expected to give all kinds of trouble before being tried; nevertheless it proves very simple and practical when in operation. The stock is set off center in order to drill the hole and the knurls are held against the work by the coil spring shown, the shank of the holder sliding in the body which is bolted to the cross slide; no eccentric collar on the spindle nose is used to operate the knurl.

A METHOD OF LOCATING KNURLS

Fig. 9 shows a method of locating knurls by the use of the washers shown at *A*. These washers are used in widths which will locate the two knurl rollers in any position in the gap *B*.

Figs. 10 and 11 are examples of knurling at an angle and show how cheap, special tools save the second operation. Much extra work is often expended on such parts as shown in Fig. 12. In this case a pin which was to be knurled on

both ends was always knurled at *A*, and the other end was later knurled in the lathe or hand-screw machine. The most economical method of handling this class of work, however, is to allow the cutoff tool to advance part way as seen in the sketch, thus giving clearance for the knurl *B* to work on both corners, after which the cutoff tool again advances and separates the work from the bar.



CROSS-SLIDE KNURLS FOR AUTOMATIC SCREW MACHINE

It should be noticed also that by using this method the cutoff tool removes the burr which the knurl has just thrown out on the ends of the work. The knurl roller is made in two parts as seen at *C*. The cheapest and best way to make these rollers is to cut a master roll and use this master for duplicating as many rollers as required. The master in this case was cut like a bevel gear and was set at 90 degrees from the tool to be made as seen at *D*.

A SIMPLE KNURLING OPERATION

An unusual piece which was knurled in a simple manner is shown in Fig. 13 where *A* is the work and *B* the pivoted arm in which is held the knurl roller *C*. This arm is operated by a stop held in the turret; a distinct advantage being that there is no idle return of the knurling tool, as the back slide, on which the tool is mounted, withdraws as soon as the work is knurled, thus allowing the tension spring *D* to return the knurl to position. This saves much time and gives a good clean cut, because the knurled surface is often spoiled by the idle return of the knurl wheel.

Dynamite for Removing Pinion from Shaft

BY EARL PAGETT

The machinists in the plant where I am employed pulled off a stunt recently, a description of which may help someone out of a tight place some time.

We were all to have a half holiday to attend the county fair and on this particular day at about 10:30 a.m., the 3-inch drive shaft on a mill broke off close in the end of the driving pinion. The pinion was about 10 inches in diameter by 14 inches long and had 15 teeth. The mill was needed badly the next morning.

The first step was to get a new shaft, which was an easy one, as the manufacturers of the mill have a local storehouse for repairs and we had only to send the teamster a few blocks to get it.

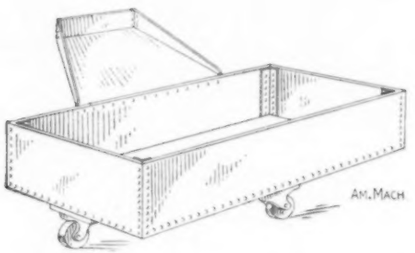
The second problem was to get the pinion off of the old shaft and onto the new one, and as it had taken about six hours of hard sledging and drilling to get this same pinion off once before when the shaft broke, it looked as if someone was doomed to miss the fair.

All efforts to drive out the old shaft did not seem to have any appreciable effect. Someone suggested dynamite, and they grabbed at the suggestion like a drowning man grabs at a straw.

The pinion was laid on its side at a safe distance from all buildings, one stick of dynamite was set against the end of the shaft where it was broken off and then mudded in with stiff clay. When everyone got under cover the dynamite was exploded. The concussion loosened things up so that five minutes' work removed the shaft, and everyone went to the fair.

A Convenient Chip Pan

The disposal of chips from automatic or hand screw machines, and other turning lathes, is sometimes quite a problem, especially in these days when high-speed steel makes the weight and bulk of the chips produced such an important item. Chip pans of various kinds have been used for many years, some being mounted on wheels, and others fastened temporarily to the machine; but all seeming to leave something still to be desired.



A CONVENIENT CHIP PAN

The chip pan shown in the illustration is of the portable type, and was found some time ago in the shops of the Bardons & Oliver Co., Cleveland, Ohio, where it has proved very useful in connection with a number of their machines. It is made of such size and shape that the receiving incline fits under the open-bed machines so as to catch the chips as they fall from the cutting tools, and directs them into the receiving box, which is mounted on good-sized wheels, to facilitate removal and replacement.

Emergency Die Stock

BY F. W. BAIR

Here is an emergency die stock I made in about ten minutes. I bored a hole in the center of a 2x4-in. board, the same size as the pipe I wanted to thread.

AN EMERGENCY DIE STOCK

Then I nailed some blocks on to keep the die from turning. When I wanted to cut a smaller pipe I nailed a block on the back side and bored a hole in it the same size as the pipe I was to cut. I kept the pipe from turning with a pipe wrench, and cut the best thread I ever made.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

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Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.
Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT
During 1911, 1,358,200 copies. For January, 1912 (American weekly, American monthly, English weekly and German weekly), total, 92,750.
Of this issue, 22,750.
None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 149

Index

The index to Volume 35 is being mailed with this issue. Those who desire an index and are not on our subscription list can secure one for the asking.

The Proposed Tariff Discrimination Against Machine Tool Builders

The AMERICAN MACHINIST rarely discusses any form of politics in its columns. But the Underwood bill now before Congress, affects the machine-tool industry so vitally that it seems necessary to point out the discrimination it proposes.

The general trend of the bill seems to be very fair, especially in view of the short time spent in its preparation. But the placing of machine tools on the free list in the same class with cash registers, typesetting machinery, printing presses, sewing machines, typewriters and tar- and oil-spreading machines, is an unjust and probably unintended discrimination.

If machine tools were as thoroughly protected by international patents as the other machines named, there could be no reasonable objection to the bill. Sewing machines, typewriters, linotypes and the others mentioned, will hardly be affected by it.

American Machinist

Machine tools, however, are exposed to direct competition from England, Germany, France and other countries, as they have almost without exception, no patent or monopoly protection. And, moreover, they are in direct competition for labor with the industries which are not affected by this bill.

The worst competitor for skilled mechanics has been the automobile industry, whose profits have enabled it to offer higher wages and secure many of the best men. And with the duty on automobiles only reduced from 45 to 40 per cent., it can be seen that it would be impossible for machine-tool builders to compete in the matter of wages. This would mean a still further migration of skilled men to the automobile shops, leaving the machine-tool builders worse off that at present.

There is an unmistakable trend toward lower and lower duties, and builders of all kinds of machinery must realize that this is sure to come, and prepare for such changes. They must prepare for a further extension of trade in foreign countries; this, of course, can hardly take place without an increase of imports of a similar character. Trade of all kinds must be a matter of give and take, all the advantage cannot permanently remain on one side or the other.

If the duty was to depend on that imposed by other countries, varying from its present 30 per cent. to zero, according to agreement or trade-treaty, there could be no logical objection to it. Its entire abolition, however, without considering either trade agreements or wage competition from machine-building lines where the duty has been left undisturbed, is a manifestly unfair discrimination.

It should be apparent that conditions are changing in all industrial lines; that to avoid unjust discrimination we must consider the problems of raw material, labor and the marketing of the finished product; that labor's raw material, food and clothing, must not be maintained at artificially high prices; that industries which compete for labor must have similar conditions and that we must have time to prepare for any of these changes, in order to minimize their effect on the stability of the industry, when they come.

Is an Even Temperature in the Shop Desirable?

In many shops there have been installed, at great expense, heating systems that are so called perfect. These arrange to supply fresh, heated air under automatic control. A desirable temperature is fixed—frequently 68 deg. F.—and the rooms are expected to be kept constantly at that temperature. The admission of fresh, heated air is supposed to force out the vitiated air, and thus provide the necessary ventilation.

This system—our present best—is beginning to be questioned. It is claimed that there is no guarantee that dead pockets do not exist in some portions of the room. It is further contended that an even temperature tends to lassitude

An ideal air condition should closely imitate that of the out-of-door atmosphere. Out of doors the air is never still. It is constantly in motion. This movement brings with it slight changes of temperature, which are invigorating and stimulating.

This being true, shop conditions would be more energizing if currents of unheated or less heated air were intermittently introduced in connection with the air heated to the fixed temperature. All of this could be easily arranged for by suitable mechanical devices.

Otto P. Geier, M. D., in advocating this innovation, wrote in *The Lancet-Clinic*, "The slight variation in temperature would stimulate the energies of the working men and their interest in the work before them, and, at the same time, improve the ventilation by causing currents between the warmer and the cooler air."

Apprenticeship in the Navy Yards

The best of apprenticeship in the machinery-building industry combines classroom instruction with manual training in the shop. The trend of trade education is decidedly in this direction, whether the classroom instruction is given in the shop at the expense of the employer, or in schools supported by public funds.

The Navy Department has a system of apprenticeship that has not been influenced by the forward movement of the last few years. Certain changes are sadly needed. Any form of apprenticeship in use in a government shop should be the best of its kind. It should be an example for private shops to follow, rather than an antiquated system out of step with the progress of the industries at large.

The navy yard apprenticeship course is for three years and the boys are divided into four classes. They must serve six months in each of the first and second classes, and one year in each of the third and fourth classes. If their work is satisfactory and they are promoted,

they pass from the grade of first-class apprentice to the grade of fourth-class mechanic. Here they must serve at least one year before they can be promoted to a higher grade. If their services continue satisfactory they are then given a certificate testifying to their good conduct and efficiency and stating that they have served full time. They are then placed on the footing of regular mechanics employed through the boards of labor employment of the yards.

Before being accepted as an apprentice each boy must be examined as to his physical condition and mental attainments, the latter including spelling and simple arithmetic. Before promotion from one grade to another, each apprentice is required to take another examination, covering the work that he has done and also some further work in arithmetic; for instance, the ground to be covered while in the first apprentice class and before promotion is as follows: Proportion, powers and roots, application of square root, prisms and pyramids, cylinders and cones, volume of spheres, the metric system of weights and measures, longitude and time, standard time, and extraction of cube root.

All of this may be very wisely planned, but how are the boys to get the necessary classroom instruction to pass the examinations? As a matter of fact they are encouraged to attend night school. In this way the ambitious ones get enough mental training to enable them to pass successfully and earn promotion. But the weak point is that an examination covering a certain amount of mental training is required, without the government providing any means at its own expense for furnishing that training.

This should be changed. The navy yard apprenticeship courses should combine classroom instruction with the shop training. The boy in the employ of the government should have as good or a better chance to learn a trade than the boy in the private shop.

Unfortunately, considerable agitation may be necessary before any results are brought about, for this is a nonpartisan and nonpolitical subject. The need is apparent.

New Publication

ADDRESSES TO ENGINEERING STUDENTS, Waddell and Harrington, editors, 493 pages, 6½x9¼ in.; Kansas City, Mo., 1911. Published by the editors, price $1.

Reviewed By Alton L. Smith*

Dissatisfaction during the past few years with the products of the engineering colleges, both in this country and in Great Britain, has led to severe criticism and many suggestions for radical changes in their organization and conduct. Many parents and some men connected with the engineering industries seem never to have realized the difficulty of making a "silk purse out of a sow's ear," but it is now beginning to be understood that one great obstacle to a satisfactory product is poor or refractory raw material.

Dr. Waddell and his coadjutor, Mr. Harrington, both engineers of prominence, in their "Addresses to Engineering Students" have had the good sense to see that it is the student who must be convicted of his shortcomings and who must be inspired with a desire to repent if he would be saved to the engineering world. Having observed this state of affairs and talked about it along with many other good people, they now live up to the creed of the engineer and do something. They have compiled 44 addresses or papers by 32 different engineers and educators, which are aimed almost exclusively at the engineering student. These addresses may be divided roughly into two classes—those for the callow undergraduate and the remainder for the maturer years at the beginning of his engineering career.

The object of the book is to impress on the student the standing of the engineering profession and its importance to the world, to furnish friendly advice concerning how to make the most of his course of instruction, how to study to best advantage, to point the right way in ethical matters for his guidance at college and in practical life afterward, and incidentally to emphasize the need of command of good, sound, forcible engineering English, something in which most all students are notoriously deficient.

The book was published after conference with several hundred professors of engineering, and practicing engineers of the United States and Canada. That the book might be put into the students' hands at a minimum price, the editors have given all but the actual cost of mechanical production of the book.

These addresses contain the very latest and best thought of men with the highest ideals for the engineering profession. Some are by teachers who are esteemed for their college work. Some are by practicing engineers who have attained prominence because of their success and high character. They present convictions rather than opinions. It is noticeable that these addresses, given at different times, places and occasions, agree practically on the following essentials for engineering success: Integrity, competence, precision, broadmindedness, ability to achieve results and ability to use good English.

Every question and phase of life is touched upon where it finds application to the environment of the young engineer. The only topics noted by the reviewer which have not been elaborated at one place or another are fraternities and the spirit of unionism which sometimes prevails in a class, whereby the abler students decline to do their best lest they jeopardize the standing of their weaker brethren.

Some idea of the scope of the book may be gained by a perusal of the index, which contains nearly 1500 titles and mentions about everything from the almighty dollar, gambling and gluttony to vandals, writing and yellow fever. The book is one which requires slow reading to secure adequate digestion. It is so full of ideas, suggestions and inspiration that he would be dull indeed who could not appreciate its worth. The editors have performed a patriotic service in putting this book at the disposal of students.

*Professor of machine design, Worcester Polytechnic Institute, Worcester, Mass.

Personals

James B. Brady has been elected vice-president of Manning, Maxwell & Moore, in place of W. C. Jacquette, resigned.

J. W. Mathes, for several years master mechanic of the Neptune Meter Co., Long Island City, has accepted a similar position with the Auto Press Co., College Point, L. I.

A. L. Saltzman, formerly assistant chief engineer of Edison Laboratories, Orange, N. J., has been made superintendent and engineer of the Primary Battery Plants, Thomas A. Edison, Inc.

L. S. Ayer has resigned from the engineering force of the Packard Motor Car Co., in order to assume the position of production superintendent with the Saurer Motor Co., Plainfield, N. J.

George W. Smith, superintendent and mechanical engineer of the Ingersoll Milling Machine Co., Rockford, Ill., has resigned his position. Mr. Smith was connected with the Ingersoll company for nearly 20 years.

P. R. Janney, who has been manager of the Randolph Motor Car Co., Flint, Mich., has resigned in order to become associated with the Marquette Motor Co., Saginaw, Mich., where he will act in a similar capacity.

H. M. Wilcox, until recently superintendent of the Jaynes Co., Newark, N. J., has become associated with Miller, Franklin & Co., New York City. Mr. Wilcox will act as mechanical expert for this firm of business economists.

Obituary

William J. Blair, head of the Blair Tool & Machine Co., New York City, died at his home in Freeport, L. I., on Jan. 28. Mr. Blair was born in New York City in 1858, and had followed mechanical pursuits from his youth. He was keenly interested in the mechanical education of the younger generation, and devoted considerable of his spare time in teaching boys the machinist's trade at Pratt Institute, Brooklyn, N. Y.

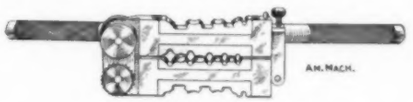
Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

Adjustable Threader

The accompanying illustration shows an adjustable threader covering a range of sizes from $\frac{1}{16}$ to $\frac{1}{4}$ in.

Hardened-steel removable die blocks are fitted into parallel jaws, adjustable



ADJUSTABLE THREADER

as to distance between them. A calibrated wheel ratchet operates a cam, which changes, by small variations, the distance between the jaws.

The threader is 15 in. long, 3 in. wide, and weighs 3½ lb. It is furnished with dies to cut U. S. standard threads, unless otherwise specified.

This threader is a recent product of the Scott-Rose Co., Marquette Building, Chicago, Ill.

Five Spindle Cylinder Borer

The machine shown herewith consists of a crossrail, which has in-and-out adjustment on the two uprights; the right-hand upright has an adjustment in and out, the left-hand upright being stationary and bolted to the bed.

There are two spindles mounted on the crossrail, each having hand cross adjustment on the rail and vertical feed and hand adjustment vertically. The left-hand vertical saddle carries a spindle of the same general design as the spindles shown on the knee on the left-hand upright, and the saddle on the right-hand upright. The left-hand saddle is bolted to the knee having vertical elevation on the upright, and in addition, there is an in-and-out hand adjustment and a cross-feed. The right-hand vertical saddle carries two spindles to operate in unison.

This machine is a recent development of the Newton Machine Tool Works, Inc., Philadelphia, Penn., especially designed for air-brake cylinder work.

Plain and Surface Grinder

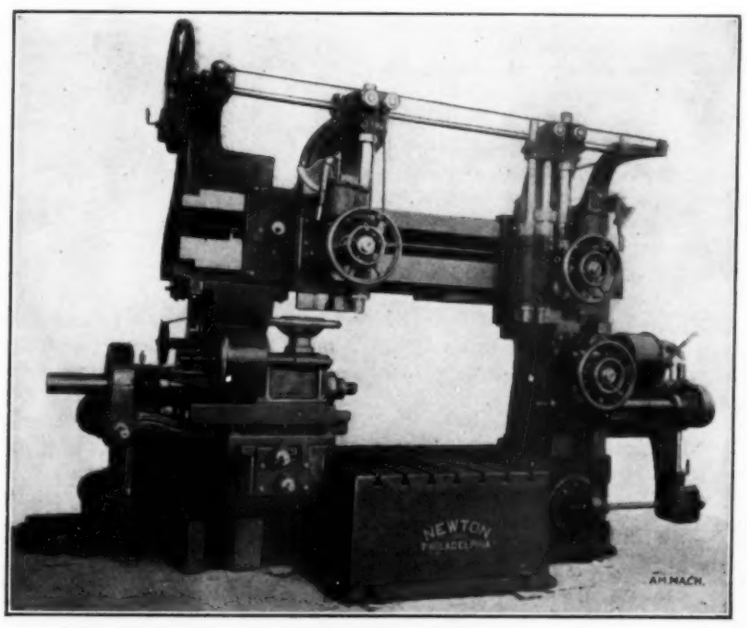
The accompanying illustration shows a plain and surface grinder recently developed by the La Salle Machine & Tool Co., La Salle, Ill.

In the main, this grinder is similar to their regular type, the chief change being in the substitution of ball bearings for the plain type.

The knee and table are counterbalanced by a weight inside the column. The table is 8x14 in., has a vertical travel of 12 in. on the guides, ¼ in. by the micrometer and may be raised to within 2 in. of the spindle center. The wheel will grind to the center of a surface 9 in. wide. The horizontal handwheel encircles the post, engaging it by a screw thread, providing a fine adjustment of the table for depth

BALL-BEARING GRINDER

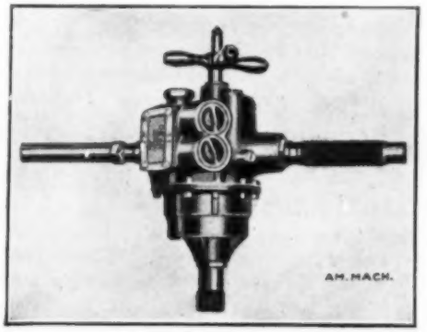
of cut. This handwheel carries a large dial graduated to read in thousandths. The opposite side is equipped for plain grinding.



FIVE-SPINDLE CYLINDER BORER

Pneumatic Driller

The accompanying illustration shows a pneumatic driller, equipped with compound planetary gears, which is particu-



PNEUMATIC DRILLER

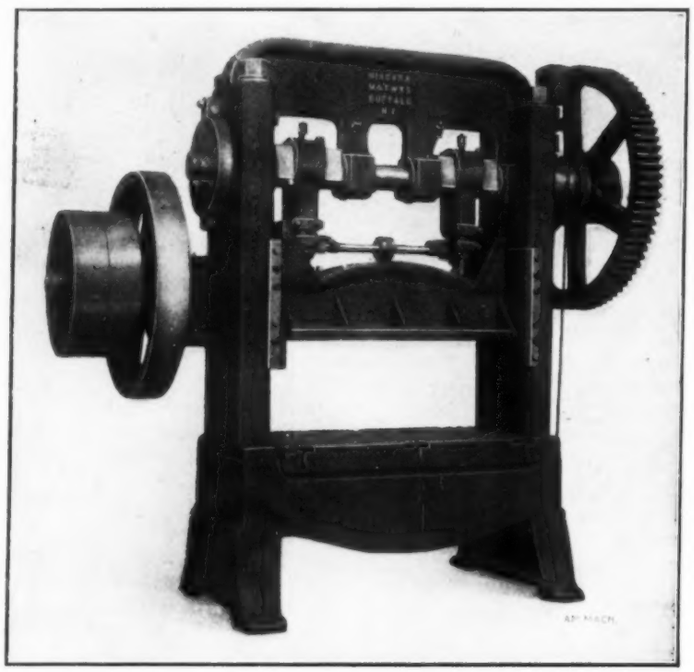
larly adapted for drilling, tapping and screwing in stay bolts and studs of all sizes up to 1¼ in. It is of the reversible type, weighs but 20 lb., equipped with No. 3 Morse taper socket, and has the regular corliss valves.

This driller is a recent product of the Independent Pneumatic Tool Co., Chicago., Ill., and it is to be known as their "one-man" driller.

Double Crank Press

The illustration shows a double-crank press, recently built by the Niagara Machine & Tool Works, Buffalo, N. Y.

The frame is built in sections. The bed, the two housings and the arch are held together by means of four steel tie rods, which are shrunk in place, and take up the strain. The press is provided with an automatic jaw clutch, with positive lock, three tool-steel faced engagement points and gravity disengagement. The clutch is provided with a safety lock, which guards against accidental engagement of the crosshead or slide, in case the brake is not properly adjusted. The distance between housings is 61 in., the area of bed, 60x35 in., and the weight of the press is 21,000 pounds.



DOUBLE-CRANK PRESS

Reducing Fire Insurance Premiums

Probably few of us ever realize that every development for preventing a fire or limiting its extent means a future benefit to the individual. The reason for this is in the fact that the present premiums charged by fire-insurance companies are figured in proportion to the fire loss extending over a term of years, with the additional company charges for service and guarantee.

Thus a reduction in fire losses will mean not only a direct saving of property and life, but a corresponding reduction in the future cost of insurance to every policy holder. Fire-insurance companies from their beginning have been developed to relieve the individual person or group of persons from a heavy fire loss, and for the individual sufferer the tax in the form of premiums is levied.

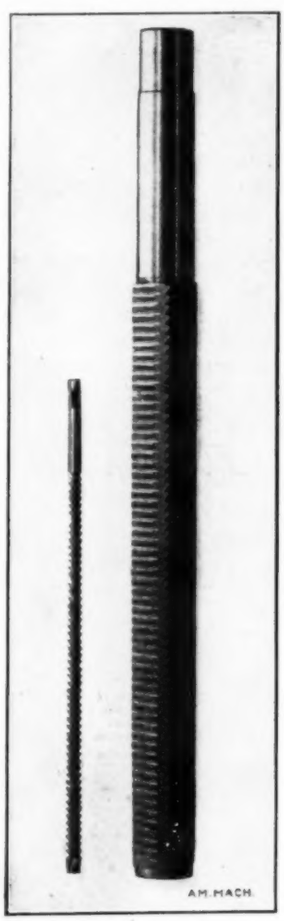
"Absolutely fireproof" does not mean very much to the well informed these days. Reinforced-concrete buildings or those with steel skeleton frames usually withstand the fiercest fires, but this does not indicate that the contents cannot be the basis of a large fire.

Automatic, sliding fireproof doors have helped considerably in confining the fire area; but probably the greatest fire-fighting asset that a building can have is an automatic sprinkler system, which not only deluges the threatened contents, but also holds the fire in check until the fire department—summoned automatically by this system—arrives.

It is evident that all modern fire-fighting devices will effect an ultimate reduction in fire-insurance premiums. Such an act as that recently passed by the Boston Chamber of Commerce, recommending that all second-class buildings in that city be equipped with sprinkler systems, is an indication of the progress of this work. These buildings have exterior walls only of combustible material. The use of proper devices means a saving that will go a long way toward paying for the cost of their installation. Incidentally the manufacturer is relieved of much of the apprehension embraced in the knowledge that the plant is improperly equipped to resist the serious development of an incipient blaze. There is a mental and material economy in such an equipment that should recommend itself to the thinking manufacturer.

The Power Required for Broaching

The illustration is interesting as showing contrasts in modern broaches. The small broach is ⅝ in. square for finishing a hole ⅝ in. square by 1½ in. long, in about one minute, from a ⅝-in. round hole into a square hole of the same size.



TWO BROACHES

The large broach is 4¼ in. square with rounded corners, and weighs 195 lb. It was made to broach a cored hole in a steel casting 4 in. long, having 1/16 in. of stock to remove on each face of the square. In other words, the cored hole is cast 4⅛ in., and the broach finishes it to 4¼ in. in one operation, requiring a force of about 16,000 to 17,000 lb. to pull the tool through the work.

These were made by the J. N. Lapointe Co., Marlboro, Mass., to whom we are indebted for the data regarding the power required.

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

METAL WORKING

NEW ENGLAND

A garage is being constructed for W. F. Thurston, Chelmsford Center, Mass.

Bids will be asked soon by the Taunton-New Bedford Copper Co., New Bedford, Mass., for the erection of a new rolling mill on North Front St.

The Boston & Maine R.R. Co. is receiving bids for erecting shops at Billerica, Mass. T. Jennings is superintendent of shops, Concord, N. H.

Plans are ready for figures on the construction of a five-story garage, 70x200 ft., at Dwight and Chestnut Sts., Springfield, Mass., for the Morse-Reaido Auto Co.

The P. H. P. Motor Truck Co., Westfield, Mass., has been purchased by I. P. Miller and others, of New York, and after improvements, the business will be conducted by them on an enlarged scale.

Work has been started on two factory buildings on Mason and Newhall Sts., for the Winchester Repeating Arms Co., New Haven, Conn. The structures will be 19x85 ft., one story high, and 30x50 ft., two stories high, of brick.

MIDDLE STATES

The Berlin Machine Works will erect, at Beloit, Wis., a factory, 275x294 ft.

The Cleveland Foundry Co., Cleveland, Ohio, will make additions to its plant.

The Cole Motor Co., Indianapolis, Ind., will install additional elevators in its plant.

The John Kohl Carriage & Auto Co., Mason, Ohio, will equip a commercial garage.

The Acme Auto Co., Cleveland, Ohio, will equip a new garage. I. C. Pollock is manager.

The foundry owned by Zahniser Bros. & Sten, of Washington, Penn., has been burned at a loss of $50,000.

The Parish & Bingham Co., Cleveland, Ohio, makers of auto pressed-steel bodies, will buy some new machine tools.

The Atlas Bolt & Screw Manufacturing Co., Cleveland, Ohio, has purchased six acres of land as a site for a new plant.

The Lake Erie Elevator Co., Toledo, Ohio, operator of grain elevators, will erect a drier house to cost $15,000, at Toledo.

The Brooklyn & Bergen Automobile Exchange, Bedford and Atlantic Aves., Brooklyn, N. Y., was destroyed by fire, Jan. 24.

The Merle & Heaney Manufacturing Co., 215 Washington St., Chicago, Ill., will erect a boiler plant at 2221 South Union Pl., costing $15,000.

The Harley-Davidson Motor Co., Milwaukee, Wis., will erect an additional factory building at Thirty-seventh and Chestnut Sts., in the spring.

The plant of the Reynolds Auto Co., Detroit, Mich., manufacturer of gasoline engines and automobiles, was partially destroyed by fire on Jan. 21.

The plant of the Detroit Forging Co., 120 Mount Elliott Ave., Detroit, Mich., has been damaged by fire to an extent of $30,000. The plant is insured for $100,000.

The McClintock-Marshall Co., of Pittsburg, Penn., structural steel engineers, have bought a large tract of land at Indiana Harbor, Ind., as a site for a plant.

The Loew Manufacturing Co., manufacturer of gasoline engines, brewers' machinery, etc., Cleveland, Ohio, will make extensions to its plant. Charles H. Loew is president, Cleveland.

The Delaware & Hudson R.R. Co. has built a new roundhouse at Binghamton, N. Y., and is preparing to install a small machine shop. H. Rogers is superintendent of buildings, Albany, N. Y.

The Youngstown Sheet & Tube Co., Youngstown, Ohio, will build a small plate mill and 8- and 10-in. hoop mills. This will be in addition to the open-hearth steel mills now under construction.

The Cincinnati Silvering & Beveling Co., Cincinnati, Ohio, has leased for 25 years a large factory building at Lawrenceburg, Ind. The company will remodel the building and establish a mirror manufactory. The plant will be in operation by Apr. 1. James R. Hageman is president.

The J. I. Case Thrashing Machine Co., Racine, Wis., manufacturer of the Case automobile, has increased its capital from $5,000,000 to $40,000,000. The added capital, it is said, will be used in extending the company's business, several new lines of manufacture being under consideration.

The Krupp Motor Car Co., Pittsburg, Penn., has engaged Irvin & Witherow, engineers, Keystone Building, to prepare plans for a group of reinforced-concrete buildings for the company's automobile works to be erected on an eight-acre site in Beaver Falls, Penn. The proposed machine shop and assembly room will be 85x300 ft., two stories high. Plans will be ready for bids Feb. 23.

The DeForest Sheet & Tinplate Co., Niles, Ohio, has awarded a contract to the McClintic-Marshall Construction Co., Pittsburg, Penn., for extensions to its plant. Improvements contemplated by the company will cost approximately $100,000, and will include four additional hot mills, a new galvanizing plant and an aluminizing plant. A steam turbine-driven generator of 1000 hp. capacity and other equipment will be installed.

The Winton Gas Engine & Manufacturing Co., Cleveland, Ohio, has been incorporated with $200,000 capital to manufacture marine engines from 200 to 400 hp. A new plant will be erected at once at West One Hundred and Sixth St., Cleveland. Alexander Winton, of the Winton Motor Car Co., Cleveland, is president, and James Winton and Labelle Winton are directors. W. S. Kinstry is secretary and treasurer, all of Cleveland.

Plans are being prepared by the Aluminum Co. of America for improvements to its plant in New Kensington, Penn., to cost $100,000, which will include an addition to the smelter plant and the construction of two additional furnaces, an addition to the machine shop, and the installation of additional equipment. The company is spending a similar amount on extensions to its works at St. Louis, Mo., and has placed orders with the Petroleum Iron Works, Sharon, Penn., for filter presses and tanks, and with the T. Shriver Co., of Brooklyn, N. Y., for stokers.

SOUTHERN STATES

S. N. Harris, Savannah, Ga., is erecting an automobile garage and repair shop.

C. Skidmore, Parkersburg, W. Va., will erect a garage, 50x165 ft., on Market St. Estimated cost, $6000.

Plans are being prepared for a one-story machine shop and office for the Furst Concrete Construction Co., Pier 2, Pratt St., Baltimore.

A five-stall roundhouse will be erected at De Quincy, La., for the Kansas City Southern Ry. C. E. Johnston, Kansas City, Mo., is chief engineer.

The New Orleans, Mobile & Chicago R.R. Co. is considering the erection of a roundhouse at Laurel, Miss. W. F. Owen is general manager, Mobile, Ala.

The Follansbee Bros. Co. has placed an order with the National Roll & Foundry Co., Farmers Bank Building, Pittsburg, Penn., for an additional cold mill, to be installed complete in its tin works at Follansbee, W. Va.

Bids are asked as follows by the Paymaster-General, United States Navy, Chief of the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for machine tools, etc.: 10 a.m., Feb. 13, Schedule 4285, Class 41, two geared pneumatic hoists, five-ton, four-strand, each complete with one plain trolley; and Class 42, one blacksmith's drill press, both for delivery at the Philadelphia navy yard; 10 a.m., Feb. 13, Schedule 4263, Class 32, one gate shear, wtih 26-in. throat depth of housings; Class 33, one 6 hp. hydraulic riveter, both for delivery at the Norfolk navy yard; 10 a.m., Feb. 13, Schedule 4288, Class 58, 120 pneumatic scaling hammers; Class 59, 130 pneumatic hammers; Class 60, four bottom riveters and eight jam riveters; Class 61, 12 short holders-on; Class 62, 135 nonreversible drilling machines; Class 63, four reversible drilling machines; Class 64, 26 corner drilling machines; Class 65, one pneumatic woodboring machine, for delivery at Brooklyn navy yard; 10 a.m., Feb. 27, Schedule 4264, Class 1, one tandem five-ton steam road roller, for transport service.

WEST OF THE MISSISSIPPI

A machine shop will be installed at Kenedy, Tex., by Levy Pullim and A. Newman.

The Day Automobile Co., St. Louis, Mo., is planning the erection of a large addition to its plant.

C. L. Ohmstead, Big Timber, Mont., contemplates erecting a factory for the manufacture of traction engines.

The Arkansas Bridge & Construction Co., Jonesboro, Ark., will establish a plant for the manufacture of tools and bridge material.

The construction work on a 20-stall roundhouse, at Argenta, Ark., for the St. Louis, Iron Mountain & Southern Ry. Co., has been started. Estimated cost, $75,000.

The repair and machine shops of the Chicago, Burlington & Quincy R.R. Co., at Creston, Iowa, were burned. J. A. Carney, West Burlington, Iowa, is superintendent of shops.

A new 10-stall roundhouse will be erected at Topeka, Kan., for the Chicago, Rock Island & Pacific Ry. Co. N. D. Ballantine is superintendent of car shops, Chicago, Ill.

PACIFIC COAST

The Johnson-Bradford Safe Co., Portland, Ore., plans to build a new manufacturing plant.

The city of Portland, Ore., contemplates the erection of a municipal repair plant and blacksmith shop.

The Winton Automobile Co., Portland, Ore., has had plans prepared for the erection of a large commercial garage.

The Terminal Construction & Manufacturing Co., Vancouver, B. C., whose plant was recently destroyed by fire, will rebuild.

The Heffernan Dry Dock Co., Seattle, Wash., plans the erection of a new manufacturing plant. J. T. Heffernan is president.

The Aviation Club, Los Angeles, Calif., has acquired a site and will soon commence the erection of a plant for the manufacture of aëroplanes.

Plans are being prepared by Edward T. Root, architect, Portland, Ore., for two factory buildings for the Johnson-Bradford Safe Co., near Linnton, Ore.

The Gruber Arms & Tool Co., San Francisco, Calif., recently incorporated by G. W. Gruber and associates, will build a plant for the manufacture of plumbers' supplies.

The Oregon-Washington R.R. & Navigation Co., Seattle, Wash., has awarded a contract for the erection of a new machine shop and power plant at Argo, Wash. The plant will be fully equipped.

CANADA

The Kenaston Iron Works will equip a new plant at Kenaston, Sask.

Brown & McKay have purchased a site at Coquitlam, B. C., for a steel works to cost $100,000.

GENERAL MANUFACTURING

NEW ENGLAND

A. F. Gerald is to build a large pulp mill at Shawmut, Me.

The carriage factory of L. N. Crocker, Detroit, Maine, was destroyed by fire, Jan. 24.

The furniture plant of French & Heald, Milford, N. H., was destroyed by fire. Loss, $100,000.

It is announced that a $3,000,000 pulp mill will be constructed in Skowhegan, Maine, during the spring.

The Bath Garage Co. has been organized at Bath, Maine, for the manufacture and sale of automobiles.

The plant of the Standard Veneer Co., at Stockholm, Maine, has been burned at an estimated loss of $50,000.

Silver Brothers, 1060 Main St., Hartford, Conn., will build a three-story addition to their candy-manufacturing plant.

The granite-polishing mill, owned by Reed C. Vendret, at Quincy, Mass., has been destroyed by fire at a loss of $6000.

The Worcester Pressed Steel Co., Worcester, Mass., will erect a frame rolling mill, 100x200 ft., two stories high, at Greendale, Mass.

The sawmill, bobbin mill and grist mill of the William S. Allen Co., West Stewartstown, N. H., were destroyed by fire. Loss, $100,000.

The carpet-cleaning plant, owned by J. B. Watkins, of 70 Quincy St., Brockton, Mass., has been burned at a loss of $3000. There was no insurance.

The Draycott Mills Co., New Hartford, Conn., will erect a large brick mill. Lockwood, Green & Co., 93 Federal St., Boston, Mass., are the architects.

The Stamford Chemical Works, North Adams, Mass., will rebuild its plant, which was recently burned, on an enlarged scale and of fireproof construction.

Bids are being received by the C. G. Garragus Machine Co., Bristol, Conn., for the erection of a brick building as an addition to its plant. A boiler house will also be built.

The Weymouth Light & Power Co., East Weymouth, Mass., is contemplating the addition of a new 1000-hp. steam turbine, one or two new boilers and a new smoke stack.

The Gardner Electric Light Co., of Gardner, has purchased property in Hubbardston, Mass., and contemplates the erection of a brick transforming station, 40 ft. square, one story high.

The Old Colony Theater Co. contemplates the erection of a new fireproof building with all uptodate conveniences, at Plymouth, Mass. It will have a seating capacity of over 1000 and will cost about $60,000.

The Rhode Island Co., Providence, R. I., is receiving estimates at its engineering office for a new car barn to be erected on Cranston St. It will be brick, 390x178 ft., two stories high, and have a sprinkler system with tank of 60,000 gal.

Plans have been completed for a new brick factory building in rear of 272 West Water St., New Haven, Conn., for Carlson & Kolelzsky, 16 Dagget St. The building will be two stories high, 25x72 ft., mill construction. Jerome C. Bailey is the architect.

F. M. Hoadley has secured an option on land on Shrewsbury St., Worcester, Mass., and will have the plans prepared for a new manufacturing building which he is contemplating erecting on the site. The plans provide for a six-story building, 80x300 ft., of concrete and steel construction.

MIDDLE STATES

Carl Berth's flour mill, at Sheboygan, Wis., was burned.

The Ringle Brick Co., of Wausau, Wis., will improve their plant.

The Toledo Calendar Co., Toledo, Ohio, will buy some printing machinery.

Power plant will be needed for the Cleveland (Ohio) water-filtration plant.

The I. Leisy Brewing Co., Cleveland, Ohio, will build an addition to its plant.

The Bucyrus (Ohio) Bending Works will erect a dry-kiln house, at its plant.

The Love Chocolate Co., Cleveland, Ohio, will buy new machinery for a factory.

The Massillon Oak Hill Coal Co., Massillon, Ohio, will buy some electric-power equipment.

The Youngstown Slate & Tin Roofing Co., Youngstown, Ohio, will buy tin-shop equipment.

The Clifton Park Lumber Co., Cleveland, Ohio, will buy new wood-working machinery.

The Holt Ice & Cold Storage Co., of Indianapolis, Ind., will install smoke consumers.

The Eau Claire (Wis.) Box Co. was destroyed by fire; also J. Younger Box Co. Loss, $16,000.

The Syndicate Pottery Co., East Liverpool, Ohio, will equip a new pottery-making plant.

Endicott, Johnson & Co. are adding another story on top of their tannery, at Endicott, N. Y.

Fire damaged the factory of the Schier Picture Moulding Manufacturing Co., at Cleveland, Ohio.

Fire destroyed the plant of the Elberta Fruit & Produce Co., Elberta, N. Y. The loss will be $25,000.

The city of Cleveland, Ohio, will buy some new machinery for pumping station to water works.

The Mechanical Rubber Co., Cleveland, Ohio, will add a new manufacturing department to its plant.

The Robinson Clay Product Co., Akron, Ohio, will erect a large warehouse on Seneca St., Buffalo, N. Y.

The Hollenden Hotel, Cleveland, Ohio, will soon buy a new power plant for new addition to be built.

The American Linseed Co., Cleveland, Ohio, has taken out a permit for erecting an addition to its plant.

The Troy (Ohio) Rubber Tire Co. has been incorporated and will equip a plant to make special automobile tires.

Endicott, Johnson & Co. are building a new large shop for increasing their shoe making, in Lestershire, N. Y.

The Edgewater Lumber Co., Cleveland, Ohio, has doubled its capital and will buy new wood-working machinery.

The plant of the New Jersey Oil & Meal Co., at Jersey City, N. J., has been destroyed by fire, at a loss of $150,000.

The Diamond Alkali Co.'s plant at Painesville, Ohio, is rapidly nearing completion. It will cost $1,000,000 to erect.

The Lake Shore Lumber & Mill Co., Cleveland, Ohio, has moved its plant and will buy new wood-working machinery.

The Yale Soap & Refining Co., Cincinnati, Ohio, will buy soap and refining machinery at once. B. Peurrung is manager.

The Pratt Oil Works, a branch of the Standard Oil Co., in the Williamsburg section of Brooklyn, N. Y., was damaged by fire.

The Pneumatic Cupola Co., Ironton, Ohio, incorporated for $50,000, will build new pneumatic cupolas. L. P. Hoult is manager.

The Binghamton (N.Y.) Ice Cream Co. is completing the erection of a new brick building in Water St., for their industry.

Fire destroyed the elevator of the Acme Malting Co., at Bloomingdale Road and Forty-fifth Ave., Chicago. The loss is $200,000.

The Ebert Furniture Co. has let a contract for a two-story addition to its plant, at Sixth and Moore Sts., Philadelphia, Penn.

The Joseph Marcus Woodworking Co., New York, N. Y., will construct a one-story factory, 46x100 ft., on the Bronx Boulevard.

Power, lighting and refrigeration plants will be required for the new large City Hospital, at Cleveland, Ohio, soon to be built.

Stribling & Lum, architects, are drawing plans for a three-story brick and stone business block for Christ Bros., at Circleville, Ohio.

The plant of the Acme Malting Co., at North Fifty-fifth Ave. and Cortland St., Chicago, has been destroyed by fire, at a loss of $200,000.

The American Textile Co., Cleveland, Ohio, has been incorporated to equip a factory to manufacture textile goods. C. W. Sceltzer is president.

The Ohio Steel & Wire Co., Youngstown, Ohio, has awarded a contract for the erection of a plant to the Hohlock Building Co., Youngstown.

The soap and lye manufacturing plant of P. C. Tomson, 27 Washington Ave., Philadelphia, Penn., was recently destroyed by fire. Loss, $100,000.

The six-story brick factory building at 222-224 East Thirty-seventh St., New York, occupied by the Vogel Cabinet Co., has been burned. Loss, $50,000.

The Cleveland, Ohio, Rubber Manufacturing Co. will absorb several smaller companies and add to mechanical and power equipments of present plant.

James J. Link, president of the Link Machinery Co., Williamsport, Penn., the plant of which was destroyed by fire, has stated that it will be rebuilt at once.

The Vinegar Bend Chemical Co., Cincinnati, Ohio, incorporated for $40,000, will erect and equip a large chemical plant. G. Guckenberg, Jr., and others are the incorporators.

The Maranville Lubricating Co., Cleveland, Ohio, has been organized to manufacture lubricating oils for automobiles. P. A. Connell, M. J. Woskopp and E. W. Farr are stockholders.

J. E. Kerman, of the Wisconsin Grain and Warehouse Commission, reported that the Minnesota and North Dakota societies of equity will erect a grain elevator, at Superior, Wis.

F. B. & J. W. Lacey have just completed a new brick building, in Water St., Binghamton, N. Y., giving them greater facilities for interior wood work, and also cigar-box making.

The Marion, Ohio, Woodworking Co. has been incorporated to engage in the general wood-working business. Incorporators, J. B. Peoples, T. N. Porter and J. E. Babcock. Capital, $10,000.

The California Citron Co., Indianapolis, Ind., has been incorporated with a capital of $20,000 by W. B. Westlake, F. C. Crowe and others, to manufacture foods, juices, etc., from orchard products.

Bids will be received by L. P. Carnet, president, and Oval Mehring, secretary, of the Indianapolis Butchers' Packing Co., Indianapolis, Ind., for the construction of a model plant as soon as plans are approved.

The five-story factory building at Fourteenth and Rockwell Sts., Chicago, occupied by C. A. Hiles & Co., the Paragon Manufacturing Co. and the Clemetsen Co., has been destroyed by fire, at a loss of $20,000.

Fred Ritter, of Indianapolis, Ind., has purchased the Bessler veneer factory, at Batesville, Ind. He will buy new machinery and begin the manufacture of furniture as soon as he is able to get the plant in operation.

The factory of the Petoskey (Mich.) Block & Manufacturing Co., Petoskey, Mich., has been almost totally destroyed by fire, at a loss of $75,000. The factory is insured at $60,000, and will probably be rebuilt at once. F. J. Schmitt is manager.

The Vulcan Manufacturing Co., structural steel, boilers, machinery, etc., will add a second story to its plant and purchase new equipment, including one 10-ton and four three-ton electric cranes. Ulrich Anderson is superintendent and general manager.

A new theater and business block is to be erected on the site of the old Second Presbyterian Church, Penn. Ave. and Seventh St., Pittsburg, Penn. A fireproof structure with a theater auditorium with a seating capacity of 2000 is the announced plan of the new owners.

The Columbia Conserve Co., Lebanon, Ind., packers of fruits and vegetables, has purchased about three acres of land at Churchman Ave. and Belt R.R., Indianapolis, Ind. The company will remodel the buildings and establish a branch manufacturing plant.

Improvements to cost at least $60,000 are to be made at the municipal water and electric-light plant, at Newcastle, Ind. New machinery will be installed. Work will begin as soon as the weather will permit. Charles Brossman, consulting engineer, Indianapolis, is planning the work.

William Goldie, Henry G. Sunnin and associates, of Wilkinsburg, Penn., will erect an artificial ice plant in that suburb of Pittsburg. Plans and specifications provide for a storage capacity of 2000 tons. The building contract has not as yet been let nor machinery contracted for.

The Public Service Commission, New York, N. Y., has awarded the contract to the Degnon Contracting Co., 60 Wall St., New York, for constructing Section 2 of the Lexington Ave. subway, Tri-Borough subway system. Section 2 extends from a point in Church St., 80 ft. north of the center line of Dey St., under Church St. and private property to Broadway and up Broadway to a point 110 ft. north of the center line of Walker St., with a station at Murray and Warren Sts. The contract price is $2,356,000.

SOUTHERN STATES

The Owens Bottle Co., Fairmount, W. Va., will build an addition to its plant.

The Consolidated Lumber Co., Indianapolis, Ind., will build a plant at Georgetown, Miss.

The plant of Benswanzer & Co., glass manufacturers, Richmond, Va., was recently destroyed by fire at a loss of $270,000.

Fire destroyed the plant of the Flat Top Ice & Storage Co., at North Fork, W. Va. Los, $200,000. Will build new refrigeration plant.

It is reported the Barrett Manufacturing Co., 17 Battery Pl., New York, N. Y., is outlining plans for the construction of a plant at Arey, Ala.

The Grace Furniture Co., Salisbury, N. C., will erect a new plant to replace the one recently destroyed by fire. Complete machinery will be required.

The Independent Ice & Cold Storage Co., Shreveport, La., has organized with $50,000 capital and will erect an ice plant of 30 tons daily capacity. S. J. Harmon, president.

Refrigerating plant will be required for a new hotel to be erected at Main and Wheat Sts., Columbia, S. C., by the Gresham Hotel Co. Estimated cost, $87,000. Architects, Sampayrac & Wilson, Columbia.

The Springfield Woolen Mills Co., Springfield, Tenn., is considering the installation of another set of machinery in order to add largely to the present capacity of its plant for manufacturing woolen blankets.

WEST OF THE MISSISSIPPI

The Freider Planing Mills, at Iowa City, Iowa, was burned. Loss, $15,000.

The Pacific Creamery Co., Mesa, Ariz., contemplates the erection of a creamery plant here.

The Dealers' Ice & Cold Storage Co., Globe, Ariz., will erect an ice plant at Miami, Ariz.

The Winkelman (Ariz.) Ice & Cold Storage Co. will make improvements and additions to its plant.

The Libby (Mont.) Lumber Co. will make extensive improvements and additions to its lumber plant.

H. A. Morey and Jas. J. Donelan, of Waverly, Iowa, propose to erect and install a gas plant at New Ulm, Minn.

The Towy Lumber Co., Lewiston, Mont., has acquired a large plot of ground and will erect a $30,000 mill.

D. R. Bentson, Albuquerque, N. M., will soon commence the erection of a fruit-canning plant. Modern machinery will be installed.

The Wright-Whittier Co., Ogden City, Utah, will erect a factory and warehouse for the canning of fruit, at Thirty-third St. and Pacific Ave.

J. H. Ehlers, of Yakt Falls, near Libby, Mont., has interested eastern capitalists in erecting a pulp and paper mill at Libby, Mont., in the spring.

Maschmeier & Schaefering, carriage manufacturers, St. Louis, Mo., will enlarge their plant at Fifteenth and Chambers St., by the erection of a two-story building.

The El Paso Milling Co., El Paso, Tex., which is owned by what is known as the Pearson syndicate, is receiving machinery for its new wood-working plant that is to be installed here.

PACIFIC COAST

The Pomona (Calif.) Valley Ice Co. will build a precooling plant.

W. R. Vise, Madera, Calif., contemplates the erection of an olive oil plant, at Madera.

The Washington Shoe Manufacturing Co., Seattle, Wash., will build an addition to its plant.

The Upland Foothill Water Co., San Bernardino, Calif., will install a new water-works system.

Half of the plant of the Oregon Iron & Steel Co., Oswego, Ore., was destroyed by fire. Loss, $65,000.

John Short, Eugene Cramer and R. K. Peters, Chehalis, Wash., will erect a new sawmill, at Randle, Wash.

The Pacific Refining & Roofing Co., San Francisco, Calif., will make improvements and additions in its plant.

The Economic Incubator Co., Los Angeles, Calif., plans to increase the capacity of its plant at Lawndale, Calif.

The California Industrial Co., Los Angeles, Calif., plans to make improvements in its power station, on Mateo St.

E. H. Perkins, Dinuba, Calif., contemplates the erection of a pumping plant. Modern machinery will be installed.

The International Portland Cement Co., Spokane, Wash., will build a new cement plant, at Trent, Wash. Estimated cost, $1,000,000.

The Southern California Hardwood & Manufacturing Co., Los Angeles, Calif., will make extensive improvements and additions in its plant.

The plant of the Richmond (Calif.) Feed & Grain Co., was destroyed by fire with a loss of $25,000. It is understood that the plant will be rebuilt at an early date.

The Kansas City Feed Mill Co. contemplates the erection of an alfalfa-meal plant and creamery, at Madera, Calif. M. N. Jones, Hollywood, Calif., represents the company.

The State Sales Co., San Francisco, Calif., plans the erection of a new plant for the manufacture of inflammable liquids at Los Angeles, Calif. Modern equipment will be installed.

The International Manufacturing & Construction Co., Los Angeles, Calif., manufacturing office fixtures and similar wood specialties, will increase the capacity of its plant. W. A. Pivirotto is president.

The Columbia River Co., Portland, Ore., recently organized, with a capital of $250,000, plans the erection, at Blind Slough, Ore., of a lumbering plant. The company maintains offices at Portland, Ore. Russell Hawkins is president.

The Oro Water, Light & Power Co., San Francisco, Calif., has acquired the properties of the Butte and Tehama Power & Irrigation Co. and the Sierra Irrigation Co. The new company will erect a generating plant at Mill Creek, Calif.

The National Lemon Products Co., National City, Calif., has been incorporated by C. B. Nordhoff, R. J. Fly and B. J. Edmonds, with a capital stock of $50,000. The company plans the erection of a plant for the manufacture of fruit juices and other byproducts.

CANADA

The Keystone Portland Cement Co. will locate a big new plant at Frank, Alta.

The Berlin Trunk & Bag Co. will equip a new factory at Berlin, Ont. A. L. Breithaupt, manager.

The Western Box & Shingle Mills Co. will purchase machinery for a new mill at Nelson, B. C.

The Canadian Mosaic Tile Co., Victoria, B. C., contemplates the erection of a new manufacturing plant.

The General Equipment Co. will locate a new factory at Montreal, Ont., for the manufacture of machinery.

Edward Box, of Owen Sound, Ont., contemplates locating a new shipbuilding plant and dry dock to cost $1,500,000 there.

The Swanson Bay Pulp Mills, Vancouver, B. C., has been acquired by Evans, Coleman & Evans, Vancouver, B. C. It is understood that improvements will be made.

The Rockford Novelty & Fixture Co. will repair the Forbes plant on Race St., Water Power, Ont., and install new machinery. The company will probably occupy its new quarters by Apr. 1.

A fire at Bancroft, Ont., destroyed the grist mill owned by S. Plews, the woolen mill of E. Reid & Sons, the woolen mill of D. Fuller, the machine shop of J. D. Payne and the electric-light plant. The total loss approximates $15,000, a part of which is covered by insurance.

NEW INCORPORATIONS

METAL WORKING

The Lexington Co., Portland, Maine, has been organized for the manufacture and sale of automobiles.

The Gifford Engine Co., Kalamazoo, Mich., has been incorporated with a capital of $50,000. It will erect a factory in Kalamazoo.

The Crawford-Hough Garage, Cleveland, Ohio, has been incorporated with a capital of $10,000. Incorporators, R. H. Lee and others.

The Rocky Mount Machine Co., Rocky Mount, N. C., has been incorporated with a capital of $50,000. T. E. Jenkins is one of the incorporators.

The Deveny Automobile Machine Co., Glasgow, Ky., has been incorporated with a capital of $50,000. The incorporators are R. S. Deveny, W. H. Jones and J. S. Cable.

The Hymen-Michaels Co. of Illinois has been incorporated at Indianapolis, Ind., with a capital of $225,000 to manufacture general iron goods. Isaac Block is interested.

The Pennsylvania Metal Co., Philadelphia, Penn., has been incorporated with a capital of $75,000. The incorporators are G. A. Sagendorysh, F. M. Johnson and J. P. Dolan.

The Wisconsin Auto Fender & Manufacturing Co., Milwaukee, Wis., has been incorporated with a capital of $15,000. The incorporators are H. Coundyser, G. Sexton and B. Elliott.

The Moss-Satterlee Electric & Railway Supply Co., Jefferson City, Mo., has been incorporated with a capital of $5000. The incorporators are W. B. Satterlee, B. C. Moss and J. Richardson.

The M. T. Tyler Co., Fall River, Mass., has been incorporated with a capital of $10,000 to manufacture iron ware and machinery. Sydney D. Jackson, president; E. S. Anthoine, clerk.

The Geo. W. Jackson Co., Chicago, Ill., has been incorporated with a capital of $150,000 to manufacture and distribute machinery. The incorporators are John A. Bloomington, Robert Thorne.

The Vexen Tool Co., Camden, N. J., has been incorporated with a capital of $2000 to manufacture steel, iron and coke. The incorporators are F. R. Hansell, G. H. Martin and J. MacPeak.

B. & L. Caster Axel Co., Chicago, Ill., has been incorporated with a capital of $250,000 to manufacture and deal in automobiles. The incorporators are A. S. Burnell, F. E. Lyon and B. J. Riseys.

The Stamm Machine Works, Aurora, Ill., has been incorporated with a capital of $3500 to manufacture and sell machinery. The incorporators are V. B. Canfield, C. E. Wilson and C. B. Wilson.

Eagle Claw Wrench Co., Chicago, Ill., has been incorporated with a capital of $25,000 to manufacture tools and machinery implements. The incorporators are C. J. Burgess, M. D. Brown and W. Brown.

The Hartman-Greilling Co., Milwaukee, Wis., has been incorporated with a capital of $75,000 to manufacture boilers and machinery. The incorporators are C. Hartman, H. Greilling and L. Barchhausen.

The Mohawk Garage Co., Brooklyn, N. Y., has been incorporated with a capital of $50,000 to store and repair automobiles. The incorporators are B. J. Roesler, A. M. Roesler and W. Roesler, Brooklyn.

The Railway Signal & Safety Co., New York, N. Y., has ben incorporated with a capital of $100,000 to manufacture railway appliances. The incorporators are D. Herman, S. L. Marcus and C. Wein, New York.

The Losure Spray Manufacturing Co., Van Buren, Ind., has been incorporated with a capital of $10,000 to manufacture compressed-air spraying machines. The incorporators are Lisander Losure and F. T. Drake.

The North Dakota Gas Engine Manufacturing Co., Lansford, N. D., has been incorporated with a capital of $25,000 to manufacture gas engines. The incorporators are J. Berg, John Dammann and A. I. Sandbo.

The Speed Press Co., Camden, N. J., has been incorporated with a capital of $25,000 to manufacture and deal in all kinds of printing machinery. The incorporators are F. R. Hansell, C. Martin and John A. MacPeak.

The Rudolph Leibmann Manufacturing Co., Newark, N. J., has been incorporated with a capital of $100,000 to manufacture metal goods. The incorporators are Rudolph Leibmann, Geo. Leibmann and A. R. Leibmann.

The Federal Screw Co., Providence, R. I., has been incorporated with a capital of $100,000 to manufacture and deal in all kinds of machinery and tools. The incorporators are L. C. Tingley, P. E. Aldrich and E. Chaffee, Providence.

The Jay Richard Co., Schenectady, N. Y., has been incorporated with a capital of $72,000 to manufacture guns and ammunition. They will also deal in automobiles and parts. The incorporators are J. A. Richard and B. C. Weaton.

The Jones Machinery & Glass Co., Columbus, Ohio, has been incorporated with a capital of $14,000 to manufacture and sell machinery for making glass. The incorporators are Walter A. Jones, J. C. Sayre, J. B. Wright, F. O. Levering, R. J. Odell.

The Acme Auto Co., Cleveland, Ohio, has been incorporated with a capital of $10,000 to do a general automobile business including a garage and repair shop. The incorporators are Willis C. Pollock, Mary E. Pollock, John D. Meyer, Susie K. Meyer, Elmer Edgerton.

The Marion Motor Section Car Co., Marion, Ind., has been incorporated with a capital of $300,000 to manufacture gasoline inspection and section cars, invented by the Worth Brothers. The incorporators are P. Matter, W. Anderson, H. Beshore, W. O. Worth and J. D. Worth.

The Allen B. Laing Co., Plainfield, N. J., has been incorporated with a capital of $20,000 to manufacture motors, dynamos and electrical machinery. The incorporators are A. B. Laing, 48 Washington Ave.; E. M. Laing, 326 Central Ave., and G. F. Graves, 301 East Sixth St., Plainfield.

The Maranville Lubricating Co., Cleveland, Ohio, has been incorporated to manufacture a device for lubricating gasoline engines. A plant will be erected at Akron, Ohio, but the offices will be at Cleveland. Christian Girl, 7103 Detroit Ave., northwest, is president of the company. P. A. Connelly, W. R. Clymer are other incorporators.

The Coby Engine Co., Cleveland, Ohio, has been incorporated with $100,000 capital to manufacture gasoline engines for automobiles and motorboats. Christian Girl, 7103 Detroit Ave., northwest, Cleveland, Ohio, is president. J. B. Hull, E. W. Fan and E. S. Coby, the inventor, are other stockholders. A new factory will be erected at once in Cleveland.

GENERAL MANUFACTURING

The Hirst Potato Machine Co., Cleveland, Ohio, has been incorporated with a capital of $100,000. The incorporator is J. Hidy.

The Air-O-Lite Co., Augusta, Maine, has been incorporated, with a capital of $1,000,000, to manufacture machines and oil. E. M. Leavitt is president.

The Milford Canning Co., Milford, Ill., has been incorporated with a capital of $100,000. The incorporators are S. G. David, J. H. Beseer and T. G. Vennum.

The Novelty Handkerchief Manufacturing Co., New York, has been incorporated with a capital of $30,000. The incorporators are H. Herz, L. Lack and H. Beer.

The National Furniture Co., Portland, Maine, has been incorporated with a capital of $100,000. The incorporators are A. H. Eastman, C. L. Beedy and J. W. Maxwell.

The Sunderman Safety Cabinet Co., Newburgh, N. Y., has been incorporated with a capital of $50,000. The incorporators are F. R. Sunderman, J. Lacey and W. Walker.

The American Culvert Manufacturing Co., Buechel, Ky., has been incorporated with a capital of $50,000. The incorporators are J. H. Alderson, J. G. Hikes and E. Fegenbush.

The L. Jenson Co., Grayling, Mich., has been incorporated, with a capital of $400,000, to operate sawmills. The incorporators are L. Jenson, R. Hanson and F. L. Michelson.

Clinch Nut Co., Chicago, Ill., has been incorporated with a capital of $75,000 to do a general manufacturing business. The incorporators are D. H. Fletcher, Harry I. Cromer.

The Geneva Gardens & Lime Co., Geneva, N. Y., has been incorporated with a capital of $225,000 to manufacture cement by J. M. Kennedy, Harry Nestor and L. G. Hoskins.

The Hunter & Strehlow Co., Peoria, Ill., has been incorporated, with a capital of $50,000, to manufacture hardware. The incorporators are J. A. Hunter, J. Strehlow and A. Westmeyer.

The Peerless Brick & Artificial Stone Co., Los Angeles, Calif., has been incorporated, with a capital of $200,000. The incorporators are C. A. Conlin, F. T. Lyman and C. B. Conlin.

The Exchange Ice & Cold Storage Co., Los Angeles, Calif., has been incorporated, with a capital of $25,000. The incorporators are J. F. Paulding, J. D. Armstrong and J. W. Dunlap.

The McInnes & Sturges Milling Co., Livingston, Ala., has been incorporated with a capital of $5000. The incorporators are H. McInnes, J. D. McInnes, W. A. Sturges and T. Sturges.

The Interstate Automobile Tire & Rubber Co. has been incorporated with a capital of $500,000. The incorporators are R. H. Falbaum, L. B. Falbaum and I. R. Strauss, all of Atlanta, Ga.

The Geo. Pickering Co. has been incorporated with a capital of $10,000 to manufacture dyes. The incorporators are Geo. Pickering and L. Fortner, 36 Strawberry St., Philadelphia, Penn.

The American Box & Lumber Co., Norfolk, Va., has incorporated with a capital of $25,000 to manufacture boxes. Wm. Beaser, president; Clinton H. Beaser, secretary, both of Cleveland, Ohio.

The Expansion Spring Rim & Tire Co., Boston, Mass., has been incorporated, with a capital of $500,000, to manufacture automobiles, wheels and tires. C. O. Doyler, Everett, Mass., is president.

The Mountain Community Co., Rahway, N. J., has been incorporated with a capital of $10,000 to manufacture leather goods. The incorporators are A. B. Aldrich, C. W. Bliss and E. M. Kolstad.

The Geneva Manufacturing Co., Geneva, Ill., has been incorporated with a capital of $2000 to manufacture sulkies and sleds. The incorporators are J. Wheeler, M. Anderson and B. Johnson.

The Western Sheet Metal Manufacturing Co., Seattle, Wash., has been incorporated, with a capital of $30,000. The incorporators are H. Arnich and D. Kilgore.

The J. M. Forester Co., Rochester, N. Y., has been incorporated, with a capital of $25,000, to manufacture machinery and machinist tools. The incorporators are F. J. Forester, M. H. Forester and H. King.

The Oakes Knitting Mills Co., Boston, Mass., has been incorporated with a capital of $75,000 to manufacture and deal in knit goods. The incorporators are R. M. Armstrong, O. F. Oakes and H. B. Green.

The Consolidated Manufacturing Co., Providence, R. I., has been incorporated, with a capital of $100,000, to manufacture fabrics and jewelry. The incorporators are A. Dimond, M. Dimond and H. Dimond.

The Chas. Griffrath Co., New York, N. Y., has been incorporated, with a capital of $25,000, to manufacture hardware. The incorporators are C. Griffrath, Long Island City, N. Y., and T. A. Shaw, New York, N. Y.

The Rumely Product Co., Mineola, N. Y., has been incorporated, with a capital of $50,000, to manufacture machinery and agricultural implements. The incorporators are L. M. Rumely, A. J. Rumely and A. Potter.

The Kentucky Paper Box Co., Louisville, Ky., has been incorporated, with a capital of $30,000, to manufacture paper boxes. The incorporators are Frederick S. Bishop, C. T. Hayden and G. B. Shumate.

The L. E. B. Manufacturing Co., New York, N. Y., has been incorporated with a capital of $50,000 to manufacture office devices and appliances. The incorporators are E. Baltzley and L. Baltzley, East Orange, N. J.

The West Rotary Engine Co. has been incorporated, with a capital of $500,000, to manufacture machinery. The incorporators are A. West, Brooklyn, N. Y., B. Short, Collingswood, N. J., and M. Meyers, New York, N. Y.

The Peerless Brick & Artificial Stone Co., Slauson Ave., Los Angeles, Calif., has been incorporated with a capital of $200,000 to manufacture bricks. C. A. Conlin, 318-319 Lissner Building, Los Angeles, Calif., is interested.

The Safe Auto Tire Co., Martinsburg, W. Va., has been incorporated, with a capital of $125,000, to manufacture and deal in automobile supplies. The incorporators are J. W. Scott, G. W. Buxton and S. W. Walker, Martinsburg.

The Hurrie Window Glass Co., Sunnyvale, Calif., has been incorporated with a capital of $400,000 to build a plant for the manufacturing of glass. The incorporators are C. J. Hurrie, W. A. Crossman, J. Haynes and F. S. Curry.

The Bowlby Cooke Piano Co., Newark, N. J., has been incorporated with a capital of $60,000 to manufacture pianos and organs. The incorporators are A. Bowlby, Shickshinny, Penn.; Francis Nott, Newark, and E. Cooke, New York City.

The Neenan Elevator Co., New York, N. Y., has been incorporated, with a capital of $2,000,000, to manufacture elevators and hoisting apparatus. The incorporators are W. Rice, 3089 Broadway, New York, and H. Knight, Fanwood, N. J.

The Cleveland Distilling Co., Cleveland, Ohio, has been incorporated with a capital of $15,000 to do a general distilling business. The incorporators are Wm. Weisheimer, Laura Weisheimer, Harry O. Spencer, Jesse Meyer, Alma Meyer.

The Co-Operative Garage Co., Cleveland, Ohio, has been incorporated, with a capital of $4000, to operate a garage and auto-livery business. The incorporators are M. L. Sampliner, William St. Clair, R. E. Jarman, A. F. Sulbach and L. H. Mertens.

The D. M. Cooper Co., Cincinnati, Ohio, has been incorporated, with a capital of $10,000, to manufacture engines and boiler equipment. The incorporators are H. L. Hagerman, Charles E. Dornette, William H. Mitchell, W. E. Kampfmueller and George A. Dornette.

The J. G. Fitzpatrick Manufacturing Co., Dover, Del., has been incorporated with a capital of $25,000 to manufacture wood and metal patterns. The incorpor-

ators are J. G. Fitzpatrick, Pittsburg, Penn.; W. H. Erskine, Turtle Creek, Penn., and A. Rector, New York.

The Individual Cup & Vending Co., Dover, Del., has been incorporated with a capital of $100,000 to manufacture vending machines and drinking cups. The incorporators are M. L. Thomas, Crafton, Penn.; D. M. Guthrie, Williamsport, Penn., and J. I. Pleyler, Pittsburg.

Trade Catalogs

R. H. Fay, Chicopee Falls, Mass. Folder. Dead-center locator and countersink. Illustrated.

The New Departure Manufacturing Co., Bristol, Conn. Ball bearings. Illustrated, 52 pages, 6x9 in.

Norton Co., Worcester, Mass. Catalog. Grinding wheels and machinery. Illustrated, 142 pages, 6x9 in.

Langelier Manufacturing Co., Providence, R. I. Bulletin No. 28-32. Multiple drilling machine. Illustrated, 4 pages, 8½x11 in.

The Armstrong Manufacturing Co., Bridgeport, Conn. Catalog. Pipe-threading machines and parts. Illustrated, 46 pages, 6x9 in.

Hawkridge Bros. Co., 303 Congress St., Boston, Mass. Catalog and price list. Tool steels, machinery steel, etc. 48 pages, 4x6½ in.

J. Faessler Manufacturing Co., Moberly, Mo. Folder. Octagonal sectional expanders, roller expanders, flue-cutting machines. Illustrated.

The Hess-Bright Manufacturing Co., Philadelphia, Penn. Form 580-3A. Ball bearings that endure and why. Illustrated, 16 pages, 6x9 in.

The Veeder Manufacturing Co., Hartford, Conn. Catalog. Revolution counters, cyclometers, odometers, tachometers, etc. Illustrated, 86 pages, 5x7 in.

Best Manufacturing Co., Pittsburg, Penn. Catalog No. 103. Valves, fittings, flanges, pipe and pipe bends, separators, etc. Illustrated, 396 pages, 4x6½ in.

The Reliance Electric & Manufacturing Co., Cleveland, Ohio. Bulletin No. 7010. Automatic starting control for motor-driven machinery. Illustrated, 8 pages, 8x10 in.

Wiley & Russell Manufacturing Co., Greenfield, Mass. Catalog No. 35. Taps, reamers, screw plates, drilling machines, bolt cutters and nut tappers, etc. Illustrated, 62 pages, 6x9 in.

Forthcoming Meetings

American Society of Engineer Draftsmen. Regular Meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Hotel Bellevue. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month, Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Canada

STORES-MAN, thorough, uptodate, energetic stores-man; one who has had a large experience in looking after materials, rather than ordering of materials; one familiar with perpetual or latest inventory systems; electrical trade preferred; good salary paid to competent man. Reply, with references, to Canadian General Electric Co., Peterboro, Ont.

Connecticut

MECHANICAL DRAFTSMAN of two or three years' experience for work on textile machinery. Apply to American Thread Co., engineering department, Willimantic Mills, Willimantic, Conn.

MODEL MAKER—First-class on instrument work, such as taximeters, speedometers, carburetors, odometers, counters, etc.; a man with ability to carry out inventor's ideas. One with technical training preferred; must have phlegmatic disposition and not be easily discouraged; must be just as ambitious to succeed while working out another's ideas as his own, even though he considers his own better, and yet may feel free to make any suggestions that will in his mind be desirable. Box 929, Am. Machinist.

Maryland

SPOON MAKER—Must be experienced and familiar with uptodate methods of making retinned steel spoons, knives and forks; good opportunity for right man; give references. Address "Expert," Am. Machinist.

Massachusetts

TOOL MAKER, all-round, in gear-jobbing shop; experienced on gear cutters, hobs and general tools; state age, experience and wages expected. Box 930, Am. Machinist.

JOBBING GEAR SHOP—Young man, experienced in gear jobbing work, to assist in estimating department and laying out work for the shop; state age, experience and wages expected. Boston Gear Works, Norfolk Downs, Mass.

SUPERINTENDENT to take charge of plant manufacturing small tools, such as cutters and drills; good opening for a man of experience and executive ability; liberal salary. Box 870, Am. Machinist.

MAN competent to run a 48x48x12-ft. Cincinnati planer on machine-tool work; also man to run 24-in. Bullard vertical turret lathe; in replying, state age, nationality, experience, places and periods of employment and salary expected. Box 809, Am. Machinist.

INDUSTRIAL ACCOUNTANT — Efficiency engineer; we wish to secure the services of a competent accountant who is prepared by sound training and successful experience to take responsible charge of the organization of factory accounting systems, scientific planning of factory work and improvement in methods to secure increased production efficiency. Our requirements are emphatically for an accountant, but we prefer a man who is also a technical graduate. We should be especially interested to hear from a man who has had marked success in constructive accounting for industrial plants or other enterprises. We are prepared to make the position attractive in respect to present salary and opportunity for the future. Application should be as complete as possible stating age, nationality, whether married or single, and giving specific details of education and experience. Clinton H. Scovell & Co., Certified Public Accountants Industrial Egineers, 40 Central St., Boston.

Michigan

DRAFTSMAN—One who has had experience in mixing and agitating machines, also conveying and flour mill machinery; state experience and wages expected. Box 861, Am. Machinist.

DESIGNER—Exceptional opening for a young machine designer with some inventive ability, to assist in experimental department and in various other details connected with a busy shop. Box 917, Am. Machinist.

MECHANICAL DRAFTSMAN—An experienced man for work in the general drawing office on a general line of work; a man having had experience in valve work and building construction preferred; in replying state age and experience, and in order to save correspondence state minimum salary which would be considered; steady employment to the right party. Sheffield Car Co., Three Rivers, Mich.

A CORPORATION operating many plants, manufacturing machines and machine parts, and now engaged in reconstructing its accounting organization, invites correspondence with men experienced in all branches of factory cost and general accounting and shop-efficiency work; no application entertained unless it states all details as to experience, names of all past employers and nature of present employment, qualifications, kind of work desired and salary required; all communications will be held in strictest confidence. Box 926, Am. Machinist.

Minnesota

DESIGNER and draftsman who is thoroughly familiar with the design and manufacture of folding film cameras; write in confidence, giving full particulars as to experience, age and salary expected. Box 831, Am. Machinist.

New Jersey

ELECTRICAL INSTRUMENT MAKERS —Several, first class, for our experimental department. Call or communicate with Mr. E. F. Harder, Manager Newark Works, Westinghouse Electric & Mfg. Co., Newark, N. J.

New York

TOOL MAKER—Familiar with small jig and subpress die work, to take charge of tool department. Box 947, Am. Machinist.

SALESMAN on commission basis, in Pacific Coast States to represent die-casting manufacturer; reference required. Box 921, Am. Machinist.

FIRST-CLASS horizontal boring-machine and planer hands; permanent position and good opportunity for advancement, if competent; state experience and wages expected. Box 924, Am. Machinist.

MECHANICAL DRAFTSMAN for general and detail work; man experienced on valves or hydraulic lines preferred; state age, married or single, experience, if now employed or where last employed; salary expected to start with; good opportunity for right man. Box 931, Am. Machinist.

FOREMAN—Machinist with executive ability to act as foreman and take charge of about 25 men and boys in factory where hardware specialties are manufactured; only uptodate man and hustler wanted; state age, references and salary; German-American preferred. Box 920, Am. Machinist.

Ohio

MECHANICAL ENGINEER and gas-engine salesman; capable. Box 916, Am. Machinist.

INSTRUCTOR—An experienced machine-shop foreman or superintendent to take position as instructor of apprentices; must be a technically-trained man; splendid opportunity. Box 915, Am. Machinist.

DESIGNER—A first-class printing-press designer; a responsible and well established company, who are developing a rotary press, wants to secure a press designer who has had a broad experience in this line; the right man can command a good salary and secure a stock interest in the company; all correspondence strictly confidential. Address "Rotary Press Builder," Box 867, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

TOOL MAKERS—Several first-class tool makers, experienced on small, accurate die work; state experience and salary wanted. Box 811, Am. Machinist.

TOOL MAKER—Experienced on small electrical work, incandescent-lamp sockets, snap switches, etc. Address in confidence, giving full particulars, Wirt Electric Specialty Co., Germantown, Phila.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and compocing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

POSITIONS WANTED

Connecticut

TECHNICAL MECHANIC, graduated, 10 years' experience tool and die maker, tool and machine designer, able to handle men, wishes to change. Box 925, Am. Machinist.

FACTORY MANAGER or superintendent; connected with one of the most progressive concerns of the country, desires a change; broad experience with successful corporations in varied lines of product; thorough mechanic, systematizer and executive. Box 834, Am. Mach.

Indiana

FOREMAN—Toolmaker who can handle tool designing. Box 939, Am. Machinist.

DESIGNING ENGINEER, with 20 years' experience on machine tools and manufacturing problems. Box 938, Am. Machinist.

'DESIGNER, who can design first-class equipment for manufacturing at lowest cost; technical, practical and reliable. Box 922, Am. Machinist.

Massachusetts

FOREMAN of machine shop; 18 years' practical experience; best of references; American, 39 years old; free to take position Apr. 1. Box 927, Am. Machinist.

AMERICAN, inventor and practical mechanic, experienced as foreman, superintendent, chief designer on jigs, all kinds of dies, complicated and special machinery, desires responsible position. Box 900, Am. Machinist.

New Jersey

MECHANICAL DRAFTSMAN—Graduate; one year's shop and two years' office experience. Box 933, Am. Machinist.

FOREMAN—Has had 10 years' experience handling men, uptodate shops; progressive; good organizer of shop force. Box 937, Am. Machinist.

FACTORY SUPERINTENDENT, familiar with interchangeable production of high-grade parts; state age, experience and salary expected. Box 934, Am. Machinist.

SUPERINTENDENT, with executive experience in both shop and drawing room; high-class original designer, familiar with modern tools, uptodate shop methods, and tactful with men, is open for engagement. Box 946, Am. Machinist.

New York

MECHANICAL DRAFTSMAN wishes position. Box 940, Am. Machinist.

SUPERINTENDENT or manager with large concern by an uptodate live man. Box 837, Am. Machinist.

DESIGNER, experienced in designing special and automatic machinery, wants position. Box 483, Am. Machinist.

DRAFTSMAN—Practical designer of automatic machinery; first-class shop and office experience; accurate and reliable. Box 905, Am. Machinist.

SUPERINTENDENT or general foreman of small manufacturing plant; experienced in all kinds of electrical apparatus. Box 935, Am. Machinist.

OXY-ACETYLENE welding and cutting; experienced German brings his own apparatus; repair work all kinds. "Schneider," 2128 Caton Ave., Flatbush, N. Y.

MECHANICAL DRAFTSMAN wants position with concern where ability means advancement; technical graduate; three years' shop experience. Box 942, Am. Machinist.

DESIGNER, with first-class experience on automatic and special machinery, original ideas and technical education, desires responsible position. Box 945, Am. Machinist.

DRAFTSMAN—A1 shop and office experience designing light automatic machinery with a good record for successful work; speedy and reliable worker. Box 904, Am. Machinist.

EXPERT MACHINIST, tool maker, superintendent, manager, strong executive, will accept less responsible position than ability warrants to make good connection. Box 944, Am. Machinist.

DESIGNING DRAFTSMAN is open for employment; experience Corliss steam engines, air compressor, rock drills, tools and fixtures; capable and ambitious; can furnish A-1 references. Box 911, Am. Machinist.

CHIEF DRAFTSMAN, with first-class experience on automatic special and general machinery, technical education, original ideas and knowledge of uptodate shop practice, is open for engagement. Box 919, Am. Machinist.

PRACTICAL ENGINEER, 30, 12 years' general designing and building experience, six years on rotary printing presses, wishes position with press manufacturer; capable of taking charge of design or construction. Box 932, Am. Machinist.

SUPERINTENDENT—Open for engagement at once; well advanced in scientific management, time study and differential bonus systems; been exceptionally successful in past; salary to start, $2400 per year. Box 836, Am. Machinist.

SUPERINTENDENT or assistant desires change; nearly 10 years in my present position; I am well under 40, a thorough mechanic with technical education, experienced in managing large numbers of mechanics in the manufacture of both large and small interchangeable parts and have held executive positions for the past 12 years. Box 941, Am. Machinist.

MECHANICAL ENGINEER, construction experience, technical education, 12 years' broad, practical experience, desires responsible position in manufacturing or engineering lines; forceful and energetic; have personality, tact, bearing, executive and business ability; systematic and direct; understand values and economics of production; originality and inventive ability; seven years with present employers. Box 914, Am. Machinist.

Pennsylvania

MANAGER—By technical graduate; twelve years' experience; steel foundry and general machinery business. Box 912, Am. Machinist.

PRACTICAL MECHANIC, expert, age 32; model and experimental work; 15 years' experience; able to supervise and develop intricate mechanism. Address "Inventive," Am. Machinist.

MECHANICAL SUPERINTENDENT—Open for engagement Mar. 1; good executive, organizer and systematizer; accustomed to close work; 35 years old; married; a hustler and a producer. Address Box 936, Am. Machinist.

ASSISTANT SUPERINTENDENT or foreman, wanted by young man, 25; good technical education; has worked as machinist, tool maker and draftsman; also has installed purchasing and routing departments, store and tool rooms under Taylor system; can furnish best of references; Philadelphia or Boston preferred. Box 918, Am. Machinist.

Rhode Island

ENGINEER, young, graduate, foreigner, with about three years' mechanical shop and boiler shop practice, wants position. Box 928, Am. Machinist.

Virginia

MECHANICAL ENGINEER, technical graduate; 12 years' experience in design and construction of heavy machinery, centrifugal sand and dredging pumps, hydraulic dredges and dipper dredges, mining machinery, etc.; at present chief engineer for well known Eastern pump manufacturer, desires change, either as assistant general manager, assistant chief engineer in larger concern or chief engineer in smaller concern; good systematizer; fully acquainted with correspondence, selling and buying; hustler with good commercial training and good executive ability; age 29; married. Box 943, Am. Machinist.

Wisconsin

GENERAL FOREMAN or factory superintendent, experienced on steam and gas engines, heavy and medium mill machinery and pneumatic tools; open for engagement at once; best of references. Box 876, Am. Machinist.

MISCELLANEOUS

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Portable shafting straighteners; prices reduced. J. H. Wells, Glendale, Calif.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Technical Patents. G. M. Sacerdote, M. E. and P. A., 1919 Broadway, New York.

For Sale—One new 300-ton electrically tilted hot metal mixer of latest design. Box 897, Am. Machinist.

Removal—On Mar. 1 will remove to larger quarters—No. 38 Vesey St., New York. Frevert Machinery Co.

High-grade machine work in quantities for gear cutters, hand turrets, milling machines, etc., wanted. The Seneca Falls Mfg. Co., Seneca Falls, N. Y

Tool tempering chart. 13½x1½ inches, printed in colors with full description; 10 cents postpaid. Spon & Chamberlain, 123 Liberty St., New York, publishers.

Instruction—International Correspondence Schools course due me and paid up for sale at a sacrifice; changeable for any other branch. Box 923, Am. Machinist.

Special machinery. We have the best facilities for building to order medium weight, high-grade machinery. Thirty minutes from Broadway. The Binsse Machine Co., Harrison, N. J.

WANTED — Practical railroad-shop problems in arithmetic for instruction purposes; for description and rate write Educational Secretary, Room 201 Railroad Association Building, St. Louis, Mo.

Hungary. A Budapest firm of high standing wants agencies in Hungary for a few first-class American tools. There is business here for you if you coöperate with us to get it; references exchanged. Box 512, Am. Machinist.

For Sale—One No. 14 Morgan nailing machine in first-class condition, with direct-connected 60-cycle, 220-volt motor; further particulars may be had on application to Cluett, Peabody & Co., engineering department, Troy, N. Y.

A real live firm of engineering contractors, doing fine business with consulting engineers, industrial concerns and the building trade throughout England, are prepared to represent an American house of good financial standing. Reply Box No. 1173, care of C. Mitchell & Co., Ltd., 1 and 2 Snow Hill, London, E. C.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

Talks With Our Readers

By The Sales Manager

Wm. E. Choate, treasurer, Visible Addressing Machine Company, and formerly assistant works manager, Blake & Knowles Steam Pump Company, who visited our offices recently, was asked, "How do you read the AMERICAN MACHINIST?"

He replied, "Instead of the paper kicking around the desk, until the next issue drives it to the library, or, in despair, to the waste basket; or being picked up and laid down several times with intermittent hopes that sometime, somehow, one will be able to see what is in it, and knowing full well there is undoubtedly a number of things in it that a busy man cannot afford to miss, I use this method of quick digestion and convenient assimilation.

"My handbooks are seven by nine inches, one of the seven inches being used as a binding margin, and permitting a full view of a six by nine-inch print or sketch. The loose leaves are held between press board covers, by means of two spring clips. By this means, the contents may be grouped to suit my requirements, and admit of ready expansion, division, or elimination, as occasion requires.

"First, the front, then the back cover of the journal is stripped off, the latter exposing the ends of the wire staples. These are pried up with a knife, and the folio divisions of the magazine are lifted off until the staples can be pulled out from the front by the knife blade, and without tearing.

"The advertisements are considered first, both back and front, page by page. As examined, they are stripped off and laid aside for either the waste-basket, or to be folded or reduced to size for a loose-leaf insert in handbook. No paste-pot, scissors or scribbling on index card. Instead, a ruler, or the edge of the desk, is used to tear off the surplus paper. A vertical file folder, trimmed to seven by nine inches, and the outer half of the upper side cut off, is a good jig for folding to size, or removing surplus with aid of straight edge. This easily makes a uniform insert.

"Of special value in the advertising section are the halftone cuts, which are a graphic index to the best commercial engineering construction. Again, the operations illustrated showing work and fixtures on the machine, and often giving the actual time required, assist many times in the choice of machines and methods, as well as in design. The time saved in discussion and in giving instructions to draftsmen, by the aid of such a record, is of no small moment, and as care is taken to preserve on the sheet, the name and address of the manufacturer, time is saved in starting after more details when they are required.

"After the advertisements are thus disposed of, the balance of the journal will be bound on the front by the first article in the context, and on the back by the 'Talks with our Readers.'

"Yes, it may be folded up and placed in your pocket for perusal in transit in lieu of yellow journalism, and a pleasurable and profitable habit established.

"I leave the chaff on the train, and take the kernel back to the office, and put it in my handbook for future accessible reference. I don't even have to read it all, now; I may never require to, but if I do, it is there at my elbow, as handy as the day it first arrived."

* * *

Only reliable products can be continuously advertised.

The National Bureau of Standards

By J. D. Mooney

Scientific information and data made available by investigation and research find their way slowly into applications in the arts and industries. To bridge the gap between science and engineering and to show manufacturers how knowledge gained by science can help solve their problems are important functions of the National Bureau of Standards.

That there is such an institution as the National Bureau of Standards is probably generally known among the readers of the AMERICAN MACHINIST, but it is also just as likely that few have more than a hazy idea of its work, or appreciate the growing importance of the bureau as a disseminator of useful knowledge in the manufacturing arts. As an enormous fund of this knowledge is available for the use of builders of machinery, this article has been written to make plainer to them the nature of it and how they can take advantage of the work that is now being carried on at the bureau.

THE BUREAU'S EXECUTIVE

A description of the Bureau of Standards involves an appreciation of its director, Dr. S. W. Stratton. Dr. Stratton has been identified with the bureau since its inception in 1901, and has created the principal stimulus to its steady development and growth. He has not only directed the actual scientific work, but has also carefully fostered the growth of the bureau by showing Congress its tremendous possibilities. To a student of men and character, Dr. Stratton presents an interesting and exceptional combination of the man of science with the man of deeds—scientist and executive; in appearance he is rather the captain of industry than the man of science.

Dr. Stratton received a training in mechanical engineering and later became engaged in physics. In his scientific work, he has stated, he was struck forcibly by the slowness with which scientific data are adapted to useful applications in the arts. It has been his aim, therefore, to make the bureau a sort of a clearing house for information and data collected from sources of scientific research, and available for the improvement of manufacturing methods.

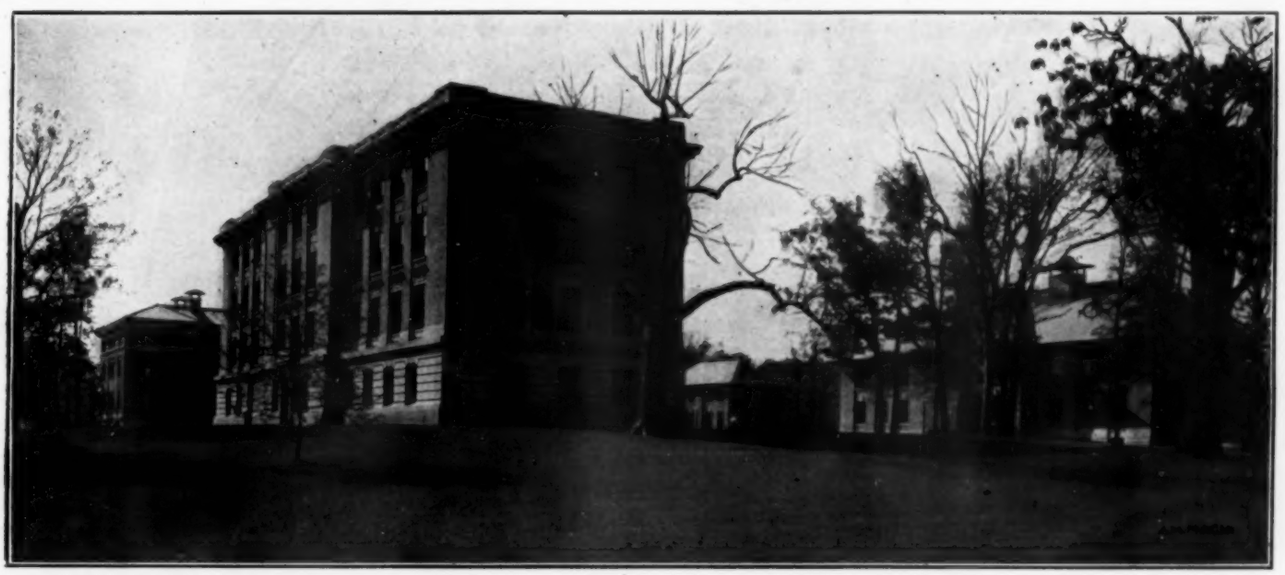
THE HISTORY OF THE BUREAU

A brief historical sketch will probably help the reader to a better appreciation of the work that has been involved in the development of the bureau, and of the work that is being carried on there now.

The bureau is the outgrowth of an office of weights and measures, established a good many years ago, to provide standards of length, mass and capacity for the custom houses, the states and some of the commercial interests. As the electrical industry grew, this office undertook also the standardization of some of the various electrical units. However, the limitations of the office, as it was originally organized, were soon reached, and it became apparent that some arrangement must be made to meet the rapidly increasing demand for standards by the scientific, commercial and manufacturing interests. As greater accuracy in the units used by the various interests was demanded, there arose the need of a central bureau to provide standards; the Bureau of Standards was organized to meet this need, to maintain primary standards, and to provide facilities for the comparison of these with secondary or working standards.

The National Bureau of Standards was established by Congress in 1891. President McKinley appointed Prof S. W. Stratton, of the University of Chicago, director of the new bureau. A site was bought in a locality free from mechanical and electrical disturbances, near Washington, D. C. The construction of two laboratories was begun immediately. A third laboratory provides liquid air for use in the work of the bureau. The fourth large laboratory, completed in 1910, provides space for investigations and tests of structural, engineering and miscellaneous materials; metallurgical work is also being developed in this building. The fifth laboratory, which is now being erected, will be devoted entirely to electricity. The bureau has three branch laboratories, the principal one being in Pittsburg, Penn. The work in that city consists principally of investigations in connection with the heavier structural materials, including metals, clay products, stone, lime, cement, etc.

The appropriation for the current fiscal year was $512,000. This amount included $200,000 for an electrical building, a twin in general construction to the West or Engineering Building, but different, of course, in the details. How the appropriation for 1911 was spent may be of



THE NATIONAL BUREAU OF STANDARDS. THE MECHANICAL LABORATORY IS SEEN ON THE RIGHT

interest: $40,000 for equipment; $75,000 for structural-material tests; $80,000 for assembling, maintaining and providing testing machines of various kinds; $15,000 for investigating the effects of electrolysis caused by the wires for power, street cars, etc.; $236,000 for salaries; $50,000 for a new building; $25,000 for general expenses; and $15,000 for repairs.

The Purpose

The bureau takes charge of and constructs the primary standards, constructs the secondary standards, their multiples and subdivisions, and compares these standards with the working standards used by the public. Another function of the bureau is to determine physical constants and the properties of materials, a work of great importance to the machine-building industry.

Besides, there is the standardization of materials of all kinds, micrometers, gages, etc. The work also includes the testing of engineering standards, as well as the testing of the various instruments for measuring temperatures.

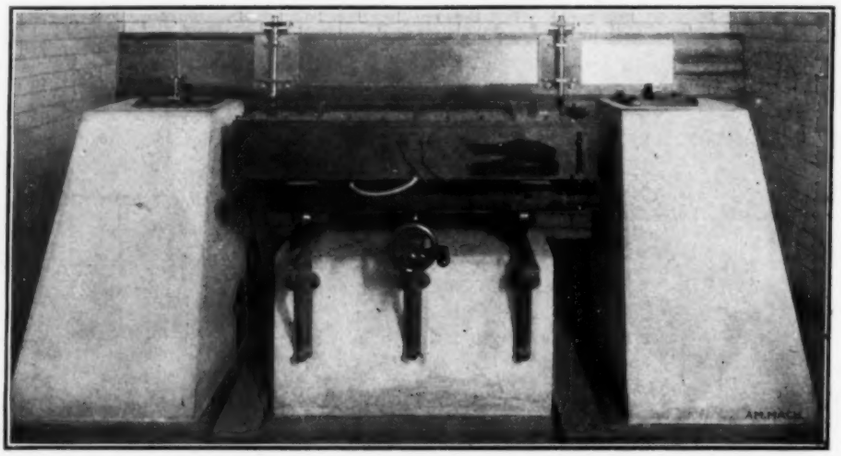
The bureau is beginning to take a very important part in the manufacture of scientific instruments. A great deal of assistance is being given to the makers of these by investigations and tests, and by conferences at the bureau with the makers. A large proportion of the scientific instruments used in this country are now being made here, and in the not very distant future a good many instruments will be exported. The bureau is playing a very important part in developing this branch of industry.

The relation of the Bureau of Standards to the manufacturing industry will continue to grow in importance, especially in its function as a sort of clearing house of information through which manufacturers can exchange ideas and from which they can receive information valuable to them in bettering the products of their plants. It is very hard for a man to keep informed on the new things that are being brought forward every day; although he may make quite a thorough study of current technical literature, there are still a good many things that will escape his notice. Therefore, when he has any particular problem on which he wishes information, the bureau can be of great assistance to him.

The work of the bureau has been briefly summarized by Dr. Stratton as follows:

1. To acquire and preserve standards of measure, and to certify copies of them; to test and investigate measuring instruments; and to determine the properties of materials.

2. To conduct researches and to investigate and develop methods of measurement; to improve instruments and apparatus for physical measurements; and to devise new apparatus, especially for

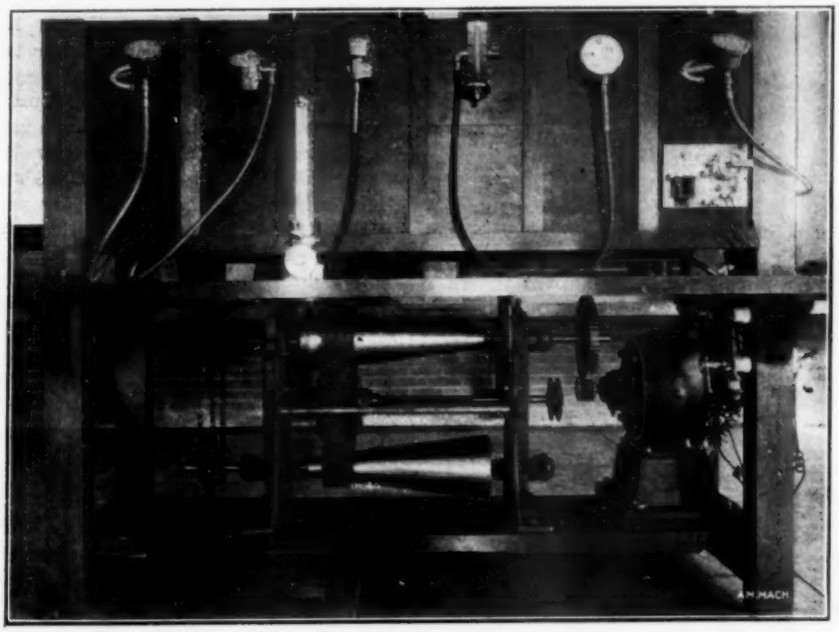


Length Standards Comparator. The Bar to be Measured Is Inclosed in a Case for Exact Temperature Regulation

The Tunnel for the Precision Testing of Steel Tapes

use in testing and in precise measurements.

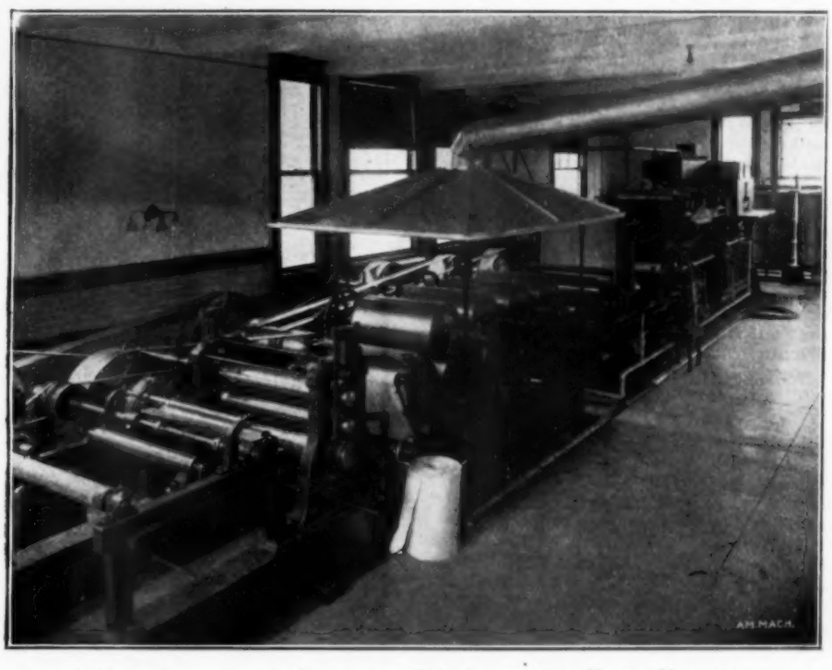
3. To distribute information regarding instruments and standards to manufacturers, state and city sealers of weights and measures, scientific and technical laboratories, and to any and every one applying for such information. This distribution of information is accomplished through correspondence and the circulars and bulletins issued by the bureau, and also through the visits of people seeking such information.



THE SPEEDOMETER TESTING APPARATUS

The importance of having instruments and standards of high accuracy for engineering and research work is growing daily. A demand is being made for greater refinement of methods, because this refinement usually means a better way of doing things, which ultimately insures better production at a lower cost. The constant efforts that are being made at the bureau for higher accuracy are not made, by any means, entirely for the satisfaction of the pure scientists; they are demanded by the more refined commercial processes that are constantly being introduced.

Specifications for use in buying material are being drawn more rigidly every day, and there is a growing tendency to buy materials on technical analyses, with penalties made for variations from these. The bureau is thus called upon very often to act as umpire in disputes that are occasioned by the inconsistencies of standards used by the purchaser and seller. Not long ago the bureau made a test which decided a dispute between a purchaser and a seller of coal. In this case the contract was based on the heat value of the coal, with a penalty clause for any deficiency in the heat value, and a premium for any excess above that stipulated. A difference of 0.05 deg. was found between the thermometers used by the two parties; this difference would have amounted to about $25,000 a year in the money paid for the coal.



A NEW MACHINE FOR TESTS AND OBSERVATIONS IN PAPER MAKING

THE ORGANIZATION OF THE BUREAU

The scientific staff is made up as follows: Director, chief physicist, chief chemist, 2 associate chemists, 2 physicists, 12 associate physicists, 25 assistant physicists, 7 asistant chemists, 38 laboratory assistants, 3 laboratory helpers, 15 aids, and 12 laboratory apprentices.

A staff of clerical assistants takes care of the editorial work, the files, records and accounts, the purchase and disbursement of supplies, the printing, and the library. The office staff also furnishes stenographic assistance to the various scientific men, attends to the mailing of publications, and other clerical work. There are now about 300 men on the entire payroll of the bureau.

The men are carefully selected by civil-service examination, and no attempt has been made by politicians to influence their appointment in any way. The bureau has been free from political influence.

The act according to which the bureau was established provides for an inspection board of five men. This board visits the bureau once a year, and is intended to guard the proper development of the work, and to report on the work of the bureau, its equipment and personnel.

THE SCIENTIFIC CORPS

The following excerpt from one of the bureau's publications outlines the work and organization of the scientific corps.

The grades, or ranks, in the scientific corps are: Laboratory assistant, assistant physicist or chemist, associate physicist or chemist, and physicist or chemist, with two or three different salaries in each grade. With a few of the higher positions yet to be provided, they constitute a series of positions with a uniform gradient of salaries from the lowest to the highest. Whenever possible vacancies or new positions are filled by promotion, new men men being appointed to the lower places, but always selected with the educational qualifications that will permit of the advancement of meritorious men through all of the grades above. Promotion in all cases

depends upon the success with which the work of the previous grade has been performed. This principle is not only adhered to in the scientific corps, but in the clerical and engineering positions of the bureau.

To provide the minor assistants in the routine testing and experimental work, a system of apprentices and aids has been established. Graduates of first-class manual training and technical high schools are appointed to the position of aid at the end of two years, or as soon thereafter as a vacancy may occur. All aids are eligible for promotion to the lowest grade of laboratory assistant, if during the period of minor service they have acquired the requisite mathematics and theoretical scientific training, provision for which is made in the evening classes of the George Washington University of Washington. While the work of the younger members of the bureau's staff is carefully supervised by its experts, independent thought and originality are encouraged, due credit being given them in the publications of the bureau, when merited.

Manufacturing concerns and engineers solve great problems by the association of experts. In like manner the different sections of the bureau coöperate and assist one another in their work. For example, the specialist engaged in the development of the fundamental electrical standards has at his hands the best facilities for the measurement of length, mass, time and temperature, and can readily consult with the corresponding experts, as well as with the chemist.

The entire scientific staff of the bureau meets once a week in a room set aside for this purpose. This room is equipped with all the facilities of a first-class physical lecture room where papers intended for publication are presented and discussed. Current literature pertaining to the work of the bureau is reviewed, and reports made as to work contemplated or in progress.

The leaders of the various sections of the bureau's work constitute a council, which meets from time to time with the director for the discussion of matters pertaining to the policy or administration of the bureau. The results of all scientific work intended for publication are submitted to the council for approval. The council has been of great assistance in the administration of the affairs of the bureau.

The working unit of the bureau's force is the section based upon a definite class of work and headed by an expert. For purposes of administration, these sections are grouped under seven divisions as follows: 1. Electricity. 2. Weights and measures. 3. Heat and thermometry. 4. Light and optical instruments. 5. Chemistry. 6. Engineering instruments. 7. Engineering, structural and miscellaneous materials.

The second division, in charge of the physicist, also comprises six sections, as follows: 1. Resistance and electromotive force. 2. Inductance and capacity and absolute measurements. 3. Electrical measuring instruments. 4. Magnetism. 5. Photometry. 6. The engineering plants.

The third division comprises the chemical work of the bureau and is in charge of the chemist, but has not as yet been subdivided into sections. As the work and personnel of the bureau grow, the more important sections will become divisions.

Contact with the Various Interests

The bureau aims to keep in close contact with commercial, scientific and manufacturing interests. This contact is accomplished in part by means of a series of bulletins describing the activities that are taking place at the bureau and the tests that are being made. This method of disseminating information and data collected at the bureau is supplemented by conferences held at times with the men of prominence in the various circles interested in the work of the bureau.

The bulletins published are issued in two separate series: 1. Scientific papers. 2. Technologic papers. The latter series covers the more distinctly technologic work of the bureau. It covers a wide range of subjects in the field of physical measurements and the properties and materials. The separate papers are issued upon request to the scientific, technical and industrial interests concerned with the subjects treated.

A View in the Instrument Shop

The Engineering Division

The engineering division of the bureau is one of the later ones established. It has already done a great deal of valuable work that has justified its establishment. In addition to the work being done at Washington, in securing data for engineering, considerable important testing work is done at the branch in Pittsburg. It is important to note that the tests made of engineering and building materials are not only the mere physical tests of individual specimens, as is done by private laboratories, but the behavior of these materials under widely varying conditions is noted.

The bureau is authorized among other things to compare the steel tapes used in engineering, surveying and manufacturing. The tapes are compared with what are called the United States bench standards, which are 100 feet and 50 meters in length, respectively. They are tested, supported throughout their entire length at certain intervals, depending upon how they are to be used in actual practice. The length of the tape submitted is determined at a definite tension, a definite number of supports, and a definite temperature. Tapes of 100 feet or less, graduated into customary units, are measured under a tension of 10 lb., and over 100 feet long at 20 lb.; or, if desired, the bureau ascertains at what tension the tape is most nearly correct at the customary temperature. The bureau does some very accurate standardization work for the Coast and Geodetic Survey; steel and "Invar" tapes are graduated to one part in a million. The bureau compares these under the same tension and at the same temperature (of melting ice) with the primary standard of length, the national prototype meter.

The engineering division does not confine its work to direct government service. It aims also to secure by various investigations technical data that will be of use to the engineering professions. The bureau is now engaged in the actual measurements of the stresses that are set up under compression and other distortions in the various structural shapes. The results of these tests are invaluable to engineers designing steel structures. For the purpose of carrying on these tests, there has recently been erected at the bureau, an Emery testing machine, which has a capacity of 2¼ million pounds in compression or tension. The new machine cost $150,000, and is a marvel of precision; it measures within two pounds of absolute accuracy.

In extending the testing and investigation of metals, and permitting a practical application of the research work in the laboratory, strain measurements were made during 1911 on structures of magnitude, such as railway bridges of large span, the lofty types of architectural structures, and steam boilers under hydrostatic pressures. These strain measurements, taken in conjunction with the

laboratory tests of the physical properties of the component parts of structures, give a complete history and record of the material for engineering purposes.

The strain measurements upon steam boilers indicate that it may be feasible to judge the efficiency of the material in the design of boilers of different types, by means of such measurements over the usual range of hydrostatic test pressures; that is, this system may enable rational rules and formulas to be developed governing the allowable steam pressures under which the boilers may be used. This information may be obtained upon boilers of current manufacture without in any way impairing their usefulness or subsequent service condition.

The strain measurements during the year comprised observations on the large structural members and main trusses of the Bankers' Trust Co. Building, in New York City, on structural members of the New York City bridges, on members of the Pittsburg & Lake Erie R.R. bridge over the Ohio River, at Beaver, Penn., on the Missouri River bridge, at Kansas City, Mo., and on steam boilers at Providence, R. I. Preparations are being made to begin this work on the massive lock gates of the Panama Canal.

Some of the various investigations now being made at the bureau of interest to engineers are as follows: A study of electrolytic effects on water and gas pipes; the reinforcing of concrete; conduits and other underground metal work; the fire-resisting properties of materials; tests on structural steel; and methods of waterproofing and dampproofing cement, etc.

The engineering division of the bureau is performing an important service for the government in testing all of the cement that is being used on the Panama Canal. The bureau has stationed inspectors at the plants of the Atlas Cement Co., which is furnishing this material, and the cement is tested at well equipped laboratories maintained right on the grounds.

Light, Heat and Electricity

The Bureau of Standards took the initiative several years ago in bringing about a definite standard of the lighting units used by the various countries. When the bureau first took up its work in lighting standards, it found a wide variation in the candlepower units used by the various electric and gas companies. However, by gaining the coöperation of the lamp manufacturers and providing them with accurate working standards, this condition has been greatly improved. In addition to maintaining a standard of light, the bureau has developed a good many photometric methods that can be quickly and generally applied by commercial companies.

The division of heat and thermometry is doing some very important work, including the determination of heat constants and the thermal properties of materials, such as specific heat, latent heat, melting points, coefficient of expansion, etc. The testing of temperature-measuring apparatus includes a wide range of physical principles and methods which must all be referred to the same standard, the ideal gas thermometer. It is interesting to note that the improvement in American-made thermometers has become so great that German manufacturers are complaining bitterly of loss in trade in this direction. The common mercury and glass thermometer has given way to more accurate types and is no longer considered an instrument for the precise measuring of temperatures.

The bureau has not only fixed the scale ranging from zero to 500 deg. C., but has developed some very accurate methods for measuring high temperatures by means of optical and radiation pyrometers.

The electrical department is coöperating constantly with the manufacturing companies in developing standards for instruments and apparatus. Very elaborate tests are now being carried on to determine the magnetic qualities of irons and steels of a wide range of varying chemical composition.

The Chemistry Department

The bureau has received the hearty support and coöperation of many of the leading testing societies in the country; among these the American Foundrymen's Association, the American Brass Founders' Association, the American Steel Manufacturers' Association, the United States Steel Corporation, the American Chemical Society, and the American Society for Testing Materials. The American Society for Testing Metals has recently organized two new committees; a committee on nonferrous alloys and a committee on alloy steel. The bureau is represented on both of these. The functions of these committees, which include some of the leading scientific men in the country, will be to suggest the future lines of the activity of the bureau in methods of analyses and to aid the bureau in selecting the necessary raw materials.

The analytical chemist has taken a place of great importance during the last few years in the manufacturing and commercial fields. A large proportion of the material is now bought on his specification and paid for according to the tests made by him. The increasing demand for new and quicker methods of analysis has put a good many problems up to the chemist.

The division of chemistry is auxiliary to all the other divisions and coöperates with them on a good many of their problems. The chemistry department does a great deal of work for the general supply committee of the government in purchasing; such materials as ink, paper, mucilage, etc., are bought on chemical analysis, which insures a certain high standard and provides a basis on which to write further specifications for these materials.

The Instrument Shop

Some very difficult work is handled in the instrument shop. Of course, the variety is great, and much of the work requires precision methods. However, the men employed here have been trained in the best American and foreign shops, and are exceptionally well qualified for it, as they are required to pass a very rigid examination that specifies among other things that they shall have had at least five years' experience in a first-class instrument shop.

The work gives the mechanician considerable opportunity to exercise his judgment and ingenuity, as little of the work is done from drawings, but rather from sketches furnished by the scientists or from their verbal explanations.

The machine shop is about 50 ft. square and contains the following machines: 10 Rivett lathes (including one precision lathe), an American planer, a 24-in. Lodge & Shipley engine lathe, a Hendey & Norton 12-in. lathe, a 12-in. Lodge & Shipley lathe, a Cincinnati universal tool grinder, three drillers, an engraving machine, a drill grinder, a metal saw, and a Walker tool grinder. Every machine is driven by an individual motor. Electric power for these motors is generated at the bureau's own power house. A small woodworking shop in connection with the machine shop contains a band saw, a rip saw and a mortising machine. About ten men are employed, including the foreman, two glass blowers and an optician.

According to *Metallurgical and Chemical Engineering*, tool sharpening can be successfully accomplished by electrolytic etching. This method, in which the tool forms the positive electrode for the etching solution in contact with it, permits rapid etching in a simple way, on a definite spot, in a definite direction and strength, depending on the position of the negative electrode, which determines the current flow. It is much better to use an external battery as source of current, instead of generating a current internally from a reaction between tool, acid and carbon. An example for the practical application of tool sharpening by the electrolytic etching method, the electrolytic file sharpening, needle-point sharpening, and relief production, as well as die-sinking work, may be mentioned. Grathwol, in Herisau, for example, succeeded in sharpening very dull files within one hour in this way. A patent was allowed him for a file-etching process in which the negative electrode, the cathode, is made of lead, and the electrolyte is sulphuric acid of about 1.18 specific gravity.

Operations on Dorris Motor Car Parts

By F. A. Stanley

Machining wristpin holes in pistons in the turret lathe and grinding pistons on a special arbor. An angular fixture used in the lathe for holding manifolds while the ends are faced, chamfered, turned, and threaded by tools carried on the spindle nose.

Milling and drilling front hangers for engines; finishing pump parts and connecting-rod brasses; slot milling valve plungers and guides.

A handy balancing rig for flywheels.

The first two illustrations in this second article on the methods of the Dorris Motor Car Co., of St. Louis, Mo., represent the operations of boring and bushing the wristpin holes in pistons.

Fig. 1 illustrates a fixture and set of tools on the flat turret lathe for holding the piston and boring the hole crosswise of the work. The fixture in which the piston is chucked is attached to the spindle nose and is bored to receive the turned work, which is secured in its seat in the chuck by means of two clamp bolts, as shown.

The tools used are forged boring tools, single-point finish boring cutter in a bar, and reamer. The hole thus machined is bushed with bronze, the wristpin being fitted tight in the connecting rod and working in the bronze bushings. The two bushes are pressed into the piston in the manner illustrated by Fig. 2.

Piston-grinding Arbor

On the bench in Fig. 2 will be noticed the special arbor used in grinding pistons. This is secured in the piston as represented in the sketch, Fig. 3, which is merely a rough outline and a partial section of the work. The arbor passes through a head which fits the bored mouth of the piston, and the enlarged inner end of the arbor has an opening crosswise, through which a pin may be slipped when passed through the wristpin holes. The nut on the arbor when tightened, holds the whole device fast to the piston, and as the latter has already been centered at the closed end during the turning operations, the work is then ready for placing upon the grinder centers.

Machining a Manifold

The manifold fixture in Figs. 4, 5 and 6 is fitted to the carriage of a Bradford lathe, and the manifold, after its feet have been faced off in a milling operation, is clamped on the lathe fixture shown, which holds it in proper position for the facing and chamfering out of the mouth, the turning of the end and the threading for the connection.

The three operations are illustrated in sequence in the halftones. The facing and chamfering tools are carried in a bar with a shank fitting the taper hole in the lathe spindle. A hollow mill is used for turning the end preparatory to the threading process, and this mill, with its three inserted blades, is mounted upon the nose of the spindle, as in Fig. 5. The threading is accomplished with an opening die, also screwed on the spindle nose, as in Fig. 6.

The three tools are changed for the operations, one after another, with little loss of time, and an awkward piece of work is thus handled with very satisfactory results.

Engine-hanger Fixture

A fixture is represented on the Cincinnati miller, in Fig. 7, for finishing the ends of bronze front hangers for engines. The casting is first placed on a boring mill, where the hub is bored and the flange faced and shouldered to fit the end of the crank case. Then these finished surfaces locate the work on the miller fixture, Fig. 7, which has a central post and seat for the casting and lugs at either end for supporting the projecting arms of the work.

A gang of cutters, the central one of which is formed to produce the rounded corners on the casting, finish the ends of the piece to width and shape to fit the frame, the work being fed vertically between the cutters. The flat pads on the face of the casting to receive the radiator, are milled on another fixture.

The jig in Fig. 8 is for drilling the numerous bolt and screw holes in the hanger. It is also used for nolding the casting while the opening in the center of the hub is tapped for the starting-crank bearing. The tap, it will be noticed, is a piloted tool, so that it will follow the bored hole accurately.

Lathe Operations

Pump blades are faced and turned off on the outside on a lathe fixture, Fig. 9,

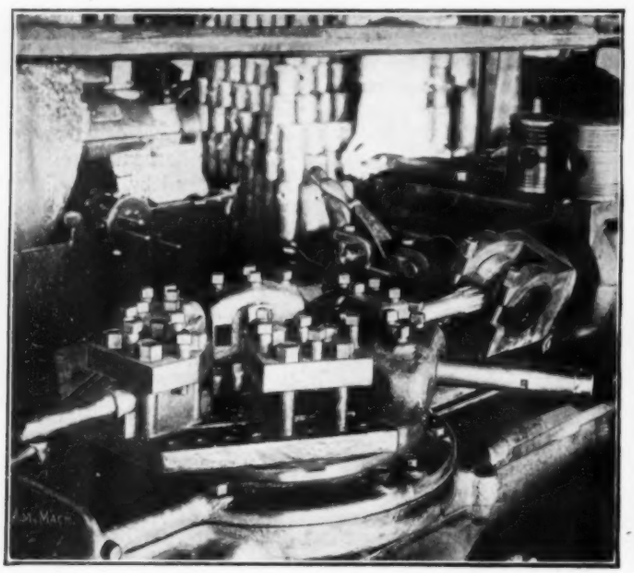


Fig. 1. Piston Operations in Flat Turret Lathe

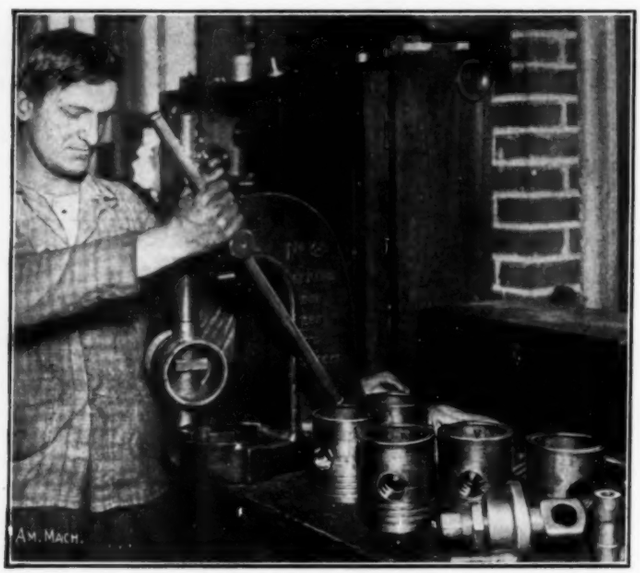


Fig. 2. Pressing Bushings into Pistons

which consists of a circular plate held in a four-jaw chuck, and provided with three collar head screws, which are tightened against the webs at the bottom of the casting to hold it in place. The work is chucked and bored out in a previous operation, and in the view shown the piece is located centrally by a stud, which fits the bore.

Fig. 10 shows the method of machining Parsons' white-bronze boxes for connecting rods. The two halves of the box, as cast, are first surfaced on the disk grinder, then soft-soldered together. The side diameter while the interior is bored out with a cutter bar, carried in the tail spindle of the lathe.

A single-point boring tool is used and

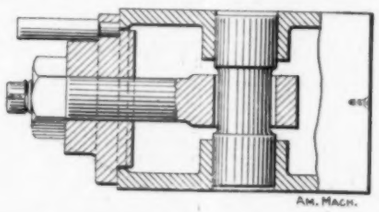
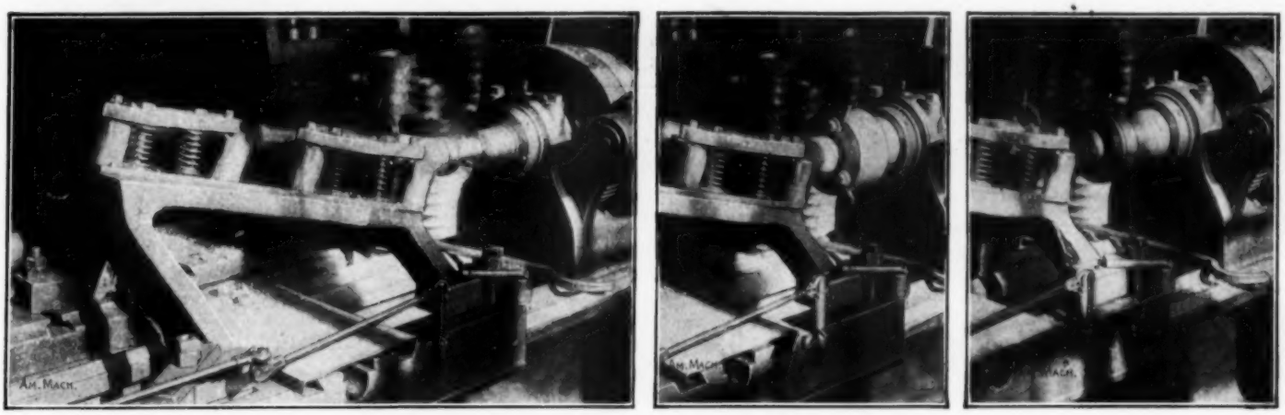


FIG. 3. PISTON GRINDING ARBOR

arated and are ready for fitting in the connecting rod and cap.

SLOT-MILLING FIXTURES

The fixture in Fig. 11 holds 40 valve plungers in two rows of 20 each, while the heads are slotted with a pair of milling cutters. The fixture has a pair of steel plates at opposite sides of the central rib at the top of the fixture, and the seats for the plungers are bored halfway in each member. The steel plates are attached by through bolts, and setscrews are tapped through to secure the work.



FIGS. 4, 5 AND 6. FACING, TURNING AND THREADING ENDS OF MANIFOLDS

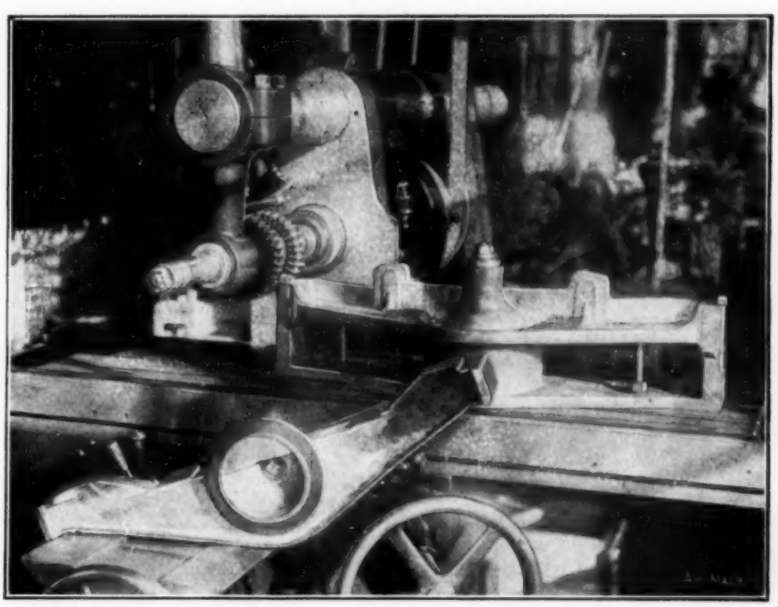


FIG. 7. MILLING ENDS OF ENGINE FRONT HANGER

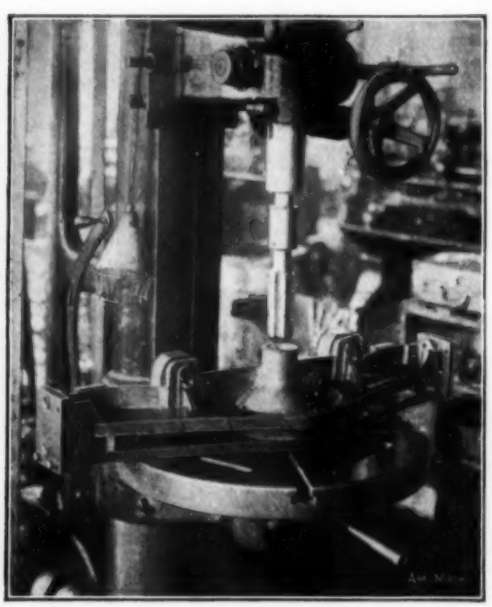


FIG. 8. DRILLING AND TAPPING JIG

box is then placed in a lathe chuck and held by one end while the surface between the flanges is turned to diameter, and the outer flange turned off.

The next operation is the boring of the box, which is accomplished in the fixture illustrated in Fig. 10. The fixture is mounted upon the spindle nose and has a removable cap, which allows the box to be put in place and removed when finished. This holds the box by the outabout 0.003 in. is left for hand-reaming to size. The boring bar is fed through the box by coupling the tailstock to the carriage and applying the regular power feed to draw the carriage and tailstock along the shears.

After the boring operation is completed, and the end of the box faced and chamfered, the box is turned end-for-end in the chucking fixture and the other end finished. The two halves are then sep-

A shallow test cut is shown in the tops of the plungers at the end of the fixture. After the job is set up and the cut is taken full depth, ¾ in., at one pass of the fixture under the arbor.

The fixtures in Fig. 12 are for notching and slotting the ends of plunger guides. The fixture seen on the knee is first used in conjunction with a half-round cutter for milling a semicircular notch in the flange of the plunger guide

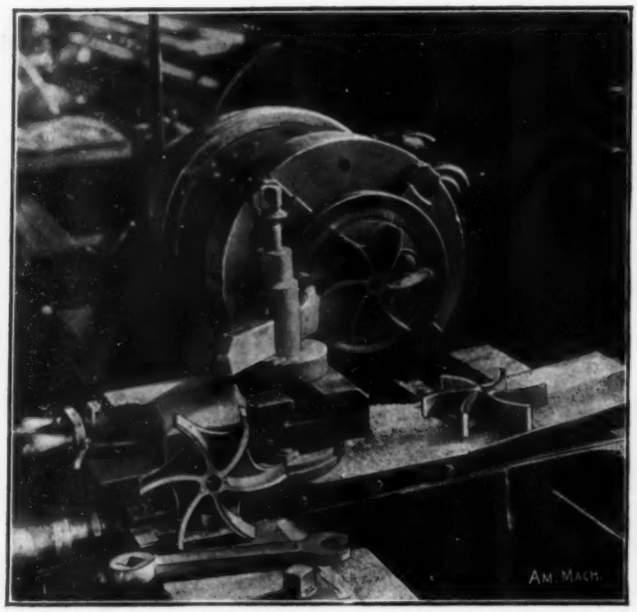


FIG. 9. MACHINING PUMP BLADES

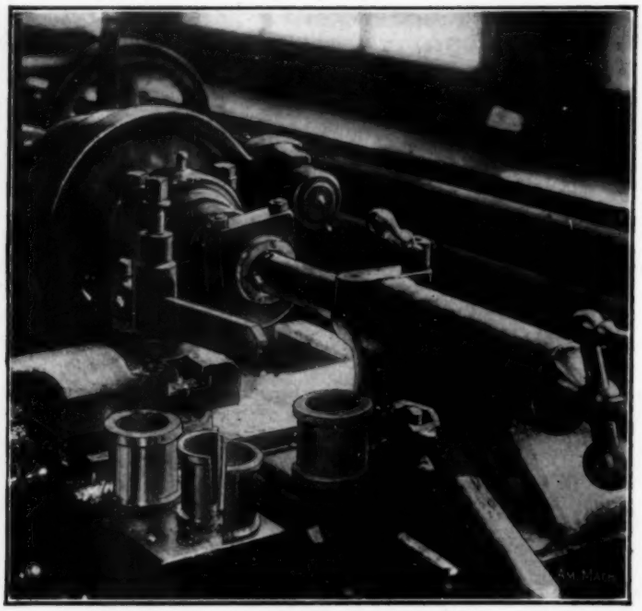


FIG. 10. MACHINING CONNECTING-ROD BOXES

to receive one side of a screw head. When in position, the flanges of the guides come close to each other, and the retaining screw heads enter halfway in each flange. This half-round opening is utilized in the next operation for locating the guide in the fixture, which holds it for the milling of the slot across the end. This second fixture is represented in operation in Fig. 12, and a sketch showing certain features of interest is reproduced in Fig. 13.

DETAILS OF THE SLOTTING DEVICE

By referring to the latter engraving it will be seen that the finished surface near the end of the plunger guide to be slotted fits the rear end of the chamber bored through the fixture, and the front end of the work slips over a pilot formed on the inner end of the split jaws which cover the mouth of the fixture. These jaws are of hardened steel and form a guide for the slotting cutter, as well as holding the front end of the work true during the cut.

The rear end of the plunger guide has a threaded projection, which is utilized in entering and removing the piece requiring slotting. The knurled coupling carried freely on the plunger *A* is run onto the thread on the work *B* and the lever is then used for sliding the work into the fixture, and is of still greater service in withdrawing the piece after the slotting operation is performed. This enables the work to be made a snug fit in the holding fixture, so that it will not chatter during the cutting of the slot, and at the same time provides a convenient means of extracting it without injuring its finished surfaces.

PULLEY-BALANCING RIG

Figs. 14 and 15 illustrate the method of obtaining the standing balance of flywheels. The wheel, which is cast with fan-shaped arms to eliminate the radiator fan, is mounted upon a special arbor and placed upon the parallels, which are supported from a cast-iron base solidly

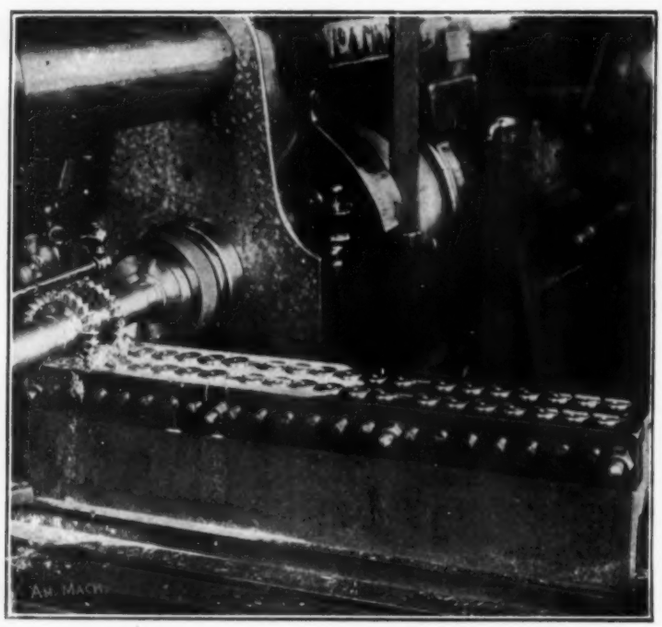


FIG. 11. FIXTURE FOR SLOTTING VALVE PLUNGERS

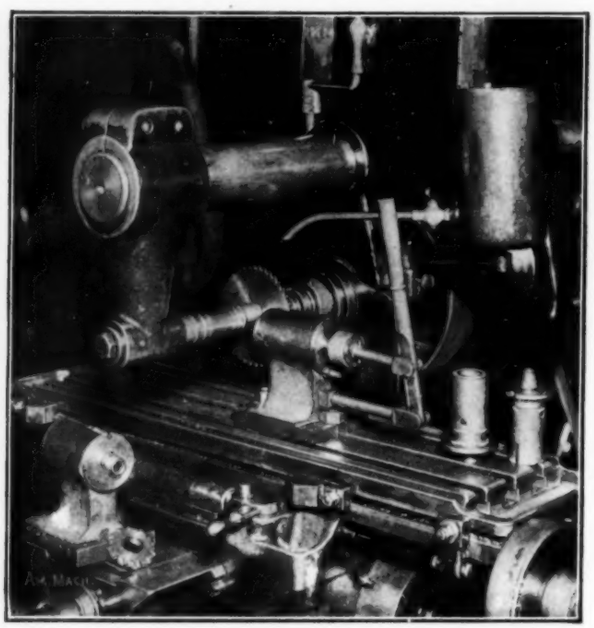


FIG. 12. FIXTURE FOR SLOTTING PLUNGER GUIDES

mounted on a concrete pier. Chipping bosses are cast between the arms and when the heavy side of the wheel has been located, the wheel is rolled off the

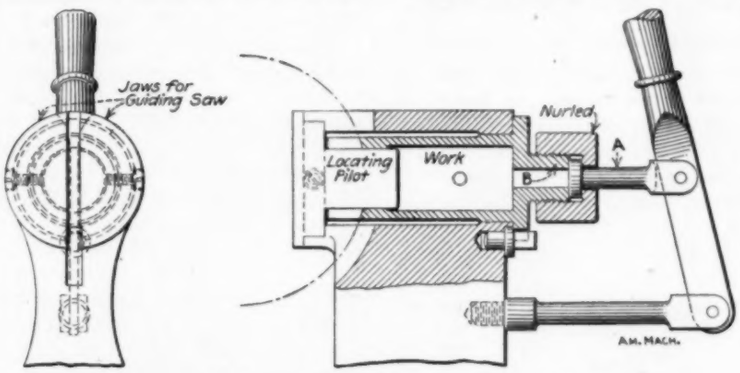


FIG. 13. FIXTURE FOR SLOTTING ENDS OF VALVE-PLUNGER GUIDES

FIG. 14

FIG. 15

parallels into a lead-lined seat on the base, where it is clamped by the metal strap, shown open in Fig. 14, and tightened down in Fig. 15. This holds the wheel securely during the process of chipping off the boss with the pneumatic hammer.

Approximate Indexing of Angles on the Miller

Divide 540 by the total number of minutes to be indexed. If the quotient is approximately equal to the number of holes in any index circle, the angular movement is obtained by moving one hole in this index circle. If the quotient does not approximately equal the number of holes in any index circle, find by trial a number by which the quotient can be multiplied so that the product equals the number of holes in an available index circle; in this circle move the index crank as many holes as indicated by the number of which the quotient has been multiplied.

Example: To cut a 101-tooth gear, spacing teeth by angles.

To find minutes:

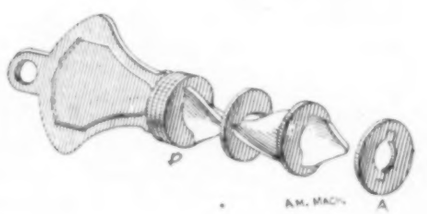
```
101)360 deg.(3.5643 deg.      0.5643
     303                        60
     ---                      -----
     570                    33.8580 minutes
     505
     ---
      or 34 minutes
      650
      606        3×60′ or 180 minutes
      ---
      440                    214 minutes
      404
      ---
       360
       303                214)540.000(2.523
       ---                    428
                              ----
                              1120
2.523×17=42.89 or 43          1070
or move 17 holes each         ----
time on the 43-hole            500
circle                         428
                               ---
                               720
                               642
                               ---
                                78
```

If the quotient of 540, divided by the total number of minutes, is greater than the number of holes in any of the index circles, the movement cannot be obtained by simple indexing.

A Method of Making an Internal Spiral

BY J. A. HURDLE

The diagram shows a method of making an internal spiral, which is applicable to many purposes and has been used by me as a keyhole for a lock. The internal spiral is made up of a number of thin-metal stampings, one of which is shown at *A*. The desired number of these stampings are placed close together, the same as those shown at *B* and can then be soldered together, making an internal spiral of any desired length. The thinner the stampings the greater the contact between the internal and the external spirals.



A METHOD OF MAKING AN INTERNAL SPIRAL

BALANCING FLYWHEELS

A California Machine Shop

Special Correspondence

A type of construction well adapted to its locality; a heavy wooden frame, covered with corrugated iron siding and a composition roof. Ample provision has been made to admit natural light.

A flexible system of cranes is installed.

One of the most interesting machine shops on the Pacific Coast is that of the George E. Dow Pumping Engine Co., in Alameda, Calif. This is true not only of the constructive features of the plant, which differ from those adopted in other parts of the country, but also of the manufacturing methods and systems employed in its operation. This company was in business in San Francisco for 30 years, but recently acquired a large tract of land in Alameda and erected the new works.

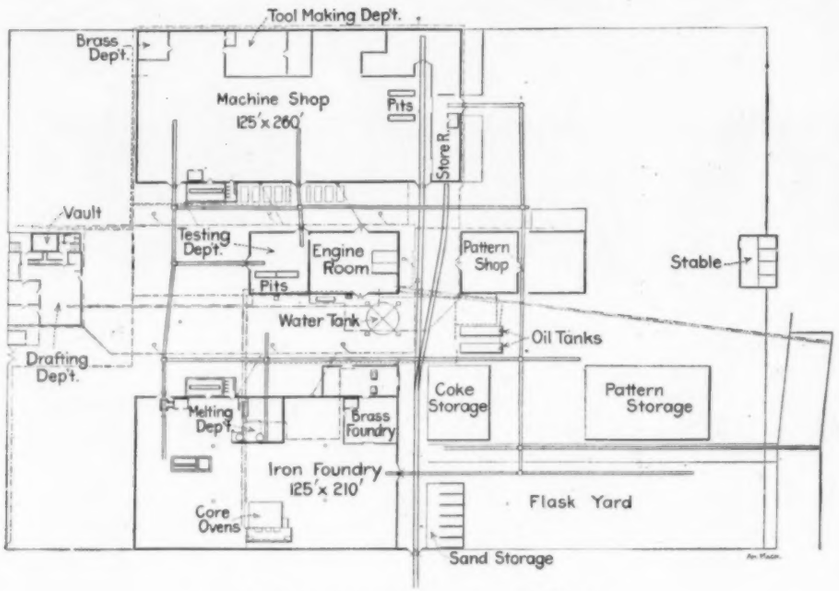


FIG. 1. GENERAL PLAN OF THE WORKS

The plant is located on deep water, on the bank of the Oakland Estuary, and is connected by a spur track to the Southern Pacific Ry. system. The company has built its own wharf and owns its own tug boats and lighters. The general ground plan of the plant is shown in Fig. 1, which also shows the industrial railway, which connects the principal manufacturing buildings. It will be noted that the general arrangement is such that the work flows from the foundry through the machine shop to shipment, either by rail or water, without doubling back on its tracks, a mistake so commonly made in plants of this kind. Provision is also made for the extension of the plant without disturbing the general plan of operation.

Fig. 2 shows a half-sectional elevation and half-end elevation of the machine shop and also the foundry, both buildings being alike in these features. They are of heavy timber construction, the walls being covered with corrugated iron, while the roofs are of composition, the trusses and uprights being held together by cast-iron brackets. The main crane girders are of the beam-box type, and adapted to carry 70,000 lb on 10-ft. centers by separate columns.

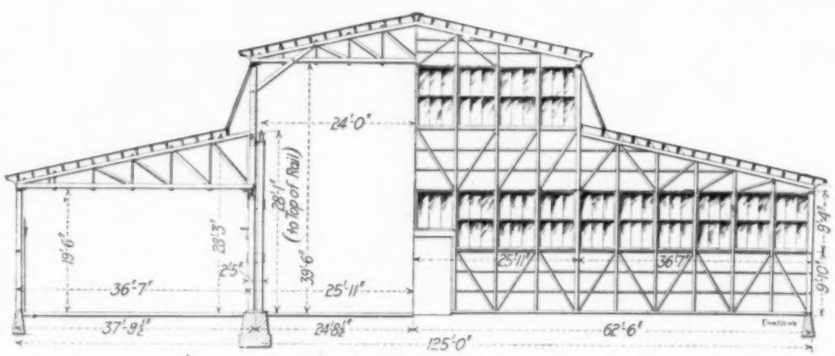


FIG. 2. SECTIONAL AND END ELEVATION OF MACHINE SHOP BUILDING

PROVISIONS FOR NATURAL LIGHT

An interesting feature is the arrangement of the window lighting in the two main buildings. Each of these buildings consists of a main central structure, with a lean-to on each side. The upper row of windows runs entirely around both sides and ends of the main structure, just under the eaves. On the ends of the main structure, these windows are, of course, vertical; but along the sides they are inclined, the lower end resting on the roof of the lean-to. This gives a much larger angle for the admission of light in the same manner as an inclined sawtooth. An added advantage is that such windows are self-washing, and do not become grimed so readily as windows set in a vertical fashion. Another row of windows runs entirely around the entire shop, lower down, just under the eaves of the lean-to, and hence high enough to greatly assist in lighting the central part of the building. The entire effect gives an excellent distribution and diffusion of light with practically no shadows. Fig. 3 shows the arrangement of these windows, as well as the exceptionally good lighting which is obtained. The absence of shadows is particularly noteworthy.

The eaves of all lean-to and other principal small buildings are the same height, thus obviating the patched-up appearance that such structures are likely to give; this, together with the circular finish under the eaves, gives the plant a finished and permanent appearance, not usually obtained with iron-covered buildings.

ARRANGEMENT OF THE CRANES

The main bays of both machine shop and foundry are equipped with overhead electric cranes and the side bays with hand travelers where needed. In addition the main bays are liberally equipped with jib cranes. A somewhat novel and useful feature of the crane equipment is that cranes of a similar kind are interchangeable in position, so that change of work, the relocation of machinery, or changes in the plant, due to growth, make rearrangement of the handling devices easy and cheap. Any jib crane can be put upon any post; and the overhead cranes of one bay will fit the track and height of any similar bay.

The Machine Shop

The machine shop is well equipped with both standard and special machine tools. Fig. 4, for instance, shows a special four-spindle boring mill used for boring the cylinders of duplex pumps, which are made in several varieties. One pair of opposing spindles is fixed in permanent alignment on a common center line, and one spindle at each end is adjustable to suit the required distance between the centers of the cylinders to be bored. Certain standard center distances have been adopted, and, as far as possible, these only are used. Accurate distance pieces for spacing the adjustable boring heads to suit these standard center distances, enable the operator to set the machine quickly and accurately and secure standard results.

The method of holding a duplex cylinder is plainly shown. The flanged end of the distance piece is clamped against the vertical face of a heavy T-slotted plate. The cylinders themselves are supported in the fixture and strapped in position.

This machine, like many others in the shop, has its own jib crane carried on an adjoining column.

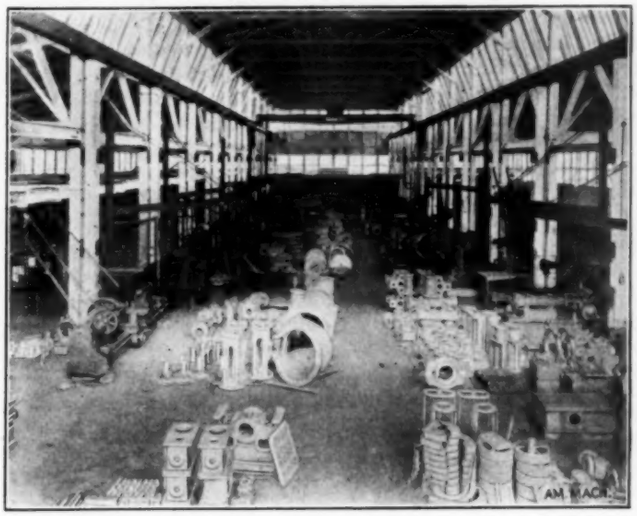


Fig. 3. Main Machine Shop Bay Showing Wooden Framing, Overhead and Wall Cranes

Fig. 4. Special Boring Mill for Duplicate Work

Filing Clippings

By Fred H. Colvin

The question of how to file clippings crops up periodically and many solutions are suggested from time to time. The system detailed here has proved of value to me as it has been in practical operation for some time.

Few of us have the space to store either bound volumes or complete files of any periodical for many years, and even if we had, it becomes quite a task to go through the indexes of each volume in an endeavor to locate some desired article.

Scrapbooks have always been very unsatisfactory, and a book on the loose-leaf order is the only thing of the kind that can be tolerated at all. But even with the loose-leaf book, we always require two copies of any article which is printed on both sides of the same sheet, and some kind of indexing is necessary in most cases. To overcome the burden of indexing, even by the most simple method, what is now known as the vertical filing system, was adopted, using in the beginning the accordion type of letter files which is adapted for use in this way. Later a filing cabinet was built, and the manila paper folder such as is now used in all vertical letter-filing systems was adopted.

By using the standard letter files, which usually have an inside dimension of 10x12⅛ inches, you can file pages from the American Machinist or any other standard-sized publication without folding. All filing is done by subjects, using guide cards as freely as seems desirable and marking the folders themselves in an upper corner so as to show their contents.

By always filing by subjects, both filing and finding are easy and require no writing whatever. This also does away with any consultation of an index. Subjects may be subdivided as closely as may seem necessary, more subdivisions being added from time to time as necessity demands. In consultation, it is only necessary to remove the folder from the file and by opening it up you have all the information on that particular subject before you. One of the advantages of this method is that it allows obsolete material to be instantly removed entirely without cost, as it does not require the destruction of loose leaves, indexing cards, or any other material.

When the same sheet contains articles on entirely different subjects in such a way that they cannot be conveniently separated, it is, of course, necessary to secure two copies if it is desired to file them under each head. Instead of this, it is usually sufficient to make a memorandum of the minor articles and file the memorandum in its proper place as though it were the article itself. This memorandum shows the name and nature of the article it represents and refers directly to the sheet containing it, which can easily be found by looking in the folder referred to. In such cases it is a help to write the word "over" on the margin of each side of the sheet to indicate that it contains valuable material on each side.

This has proved a most satisfactory method and invites fewer objections than any other plan that has been tried.

A gas-engine cylinder head, particularly of the vertical type, containing valves, inlet and exhaust passages, pockets for ignition devices, etc., makes one of the most complicated pieces of coring with which the founder has to deal. Especially as there should be as few as possible all passages and pockets should be surrounded with water, and the iron forming the walls of each should be kept apart by cores at all points, if possible.

With both cylinders and heads of a gas engine, it is very important to see that they are absolutely clean from core material. Frequently a batch of burnt or hidden coring will be left in a jacket or in a head, resulting in a hot spot in the cylinder or trouble in the head, which cannot be accounted for. Any well defined hot spot in cylinder or head may be traced through to core material or to poor design; that is to say, so much iron has been put in this particular point that there is not enough water to cool this spot.

A Semi-Automatic Profiler

Special Correspondence

A number of blanks is clamped in the jigs secured to the platen. The roughing head is then brought to cutting position and the power applied. The machine automatically profiles the blanks, passing at accelerated speed from one piece to the next. When the last piece is machined the machine stops automatically. The finishing cutter is then brought to cutting position and the pieces finished.

The accompanying illustrations show a new automatic profiler recently developed by the Pratt & Whitney Co., Hartford, Conn., for the economical production of gun and pistol parts, cams, etc.

Profiler Work Costly

The labor cost of profiler work on gun parts heretofore has been higher than that of work done on automatic machines, such as are used for milling, rifling, drilling, etc., where one operator can keep a number supplied with work. It has also been difficult to design a hand-operated machine which could be accurately controlled while operating on such sharp angles as are met in many gun and pistol parts. On the hand-operated machine the former must be of exactly the same contour as the work and any variation will be reproduced on the work. The tooling of the hand machine must be very exact and the designing and making of the fixtures and formers done by skilled men. Where curves of small radius occur in the work a correspondingly small former-pin must be used and great care and skill are necessary to operate the machine when such small former-pins are used.

One Man to Operate Several Machines

From four to six of the automatic profilers shown in Figs. 1 and 2 can be operated by one man and the quality of the work does not depend on the skill of the operator.

Shapes That Can Be Profiled

Contours of practically any shape may be accurately milled, even while the machine is operating up to the maximum strength of the cutting tool, without the slightest difficulty being experienced from the yielding of the former or straining of the former-pin. Owing to its large size the angles of the former are very easy as compared with those of the work, making the rise and fall of the reproducing element very gentle.

The head, in which the spindles are mounted, is clamped to the crossrail, and is stationary while the machine is operating; all strains thrown upon the spindle are absorbed by the rigid head, rail and uprights and do not interfere in any way with the free and easy movements of the reproducing elements.

Construction

The body of the machine is in two parts: A heavy base casting to which

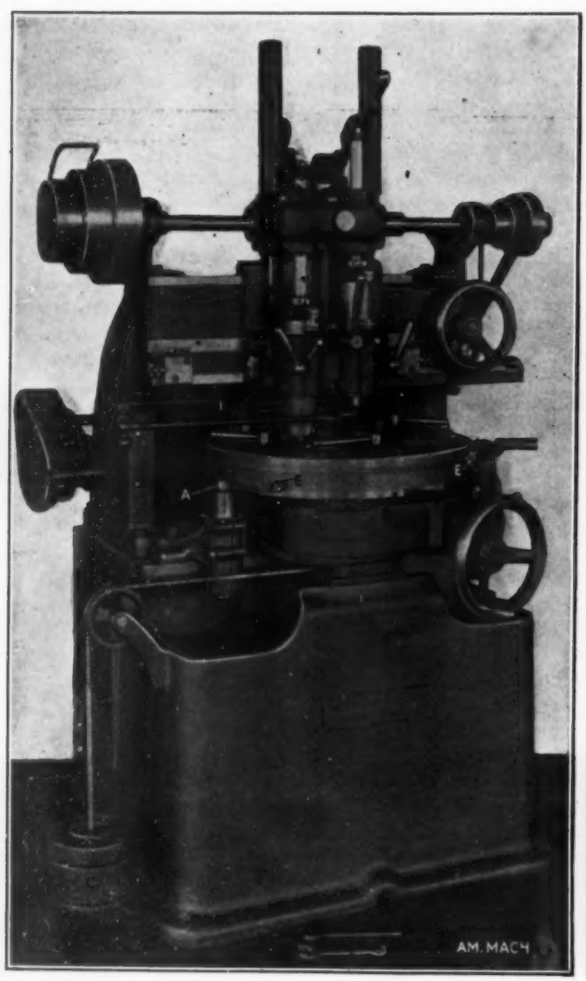


Fig. 1. Automatic Profiler with Finishing Cutter Operating on Pistol Frame

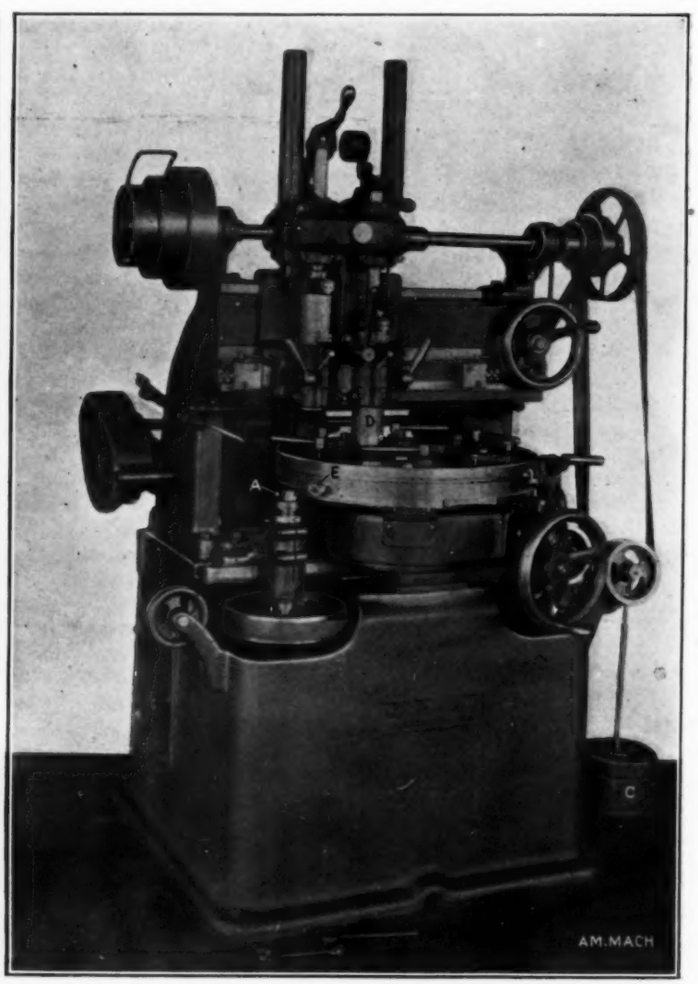


Fig. 2. Automatic Profiler, Showing the Operation of Cutting the Cam

are bolted the uprights and crossrail, cast in one piece. The rail supports the spindle carriage as shown. Roughing and finishing spindles are mounted in the carriage and means are provided whereby either of these spindles may be thrown into operating position while the other is clear of the work.

The Swinging Arm

A swinging arm is journaled in the bed between the uprights. The bearings in which it is mounted are large and far apart, so as to effectively support it whlie under cutting strains. The front end of the arm is also provided with an adjustable support traveling lightly on the bed, which assists in the further reduction of vibration.

The Rotary Table

A rotary table is mounted on the front end of the swinging arm. It is actuated by worm gearing and provided with change-gear mechanism by means of which any desired gradation of feed may readily be obtained. An important time-saving feature is the accelerated feed motion by means of which the table automatically is caused to travel very rapidly across the spaces between the work. The engagement and disengagement of this motion is automatically controlled by the dogs *E* mounted on the periphery of the table. A stop, also mounted on the table, disengages the power feed when the table has completed its rotation and is ready for the insertion of new work.

Work-holding Devices

The fixtures for holding the work are fastened to the top of the table as shown in Figs. 4 and 5. The number of pieces which can be milled at one setting depends entirely upon their size and the length of the profile being milled. The fixtures are simple in construction and readily attached, detached or interchanged.

The cam or former *B*, Fig. 1, under the rotary table, is very much larger than the work operated on and consequently tends to minify on the work any error in the cam itself. The oscillation of the table is caused by this cam being brought into contact with the roller mounted on a pin fixed to the bed as shown at *A*, Fig. 1. Suitable weights *C* and the pressure of the cut tend to keep the roller and cam in contact so that the cut is at all times positively supported by the cam and roller.

Fig. 3. Colt Automatic Pistol Frame

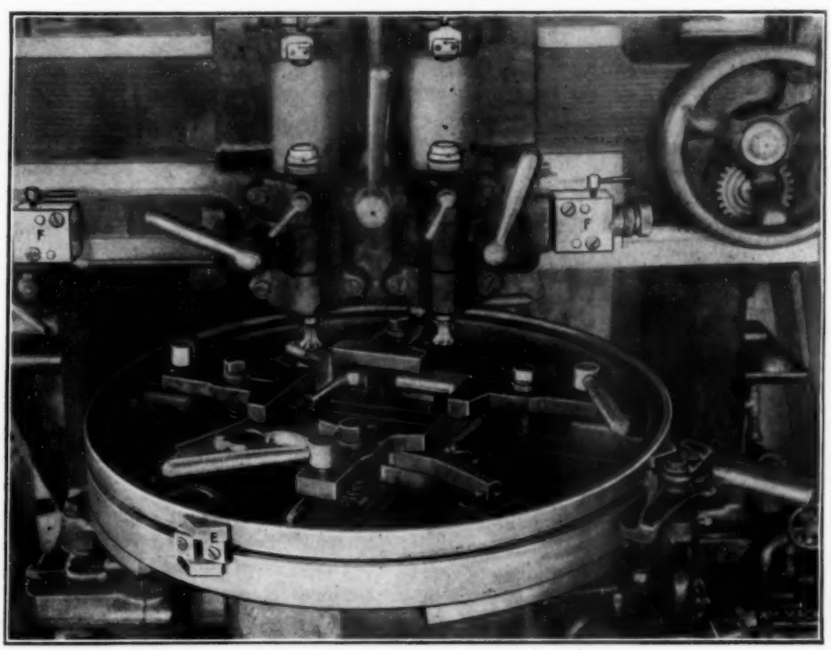


Fig. 4. Showing the Micrometer Stop

The increased diameter, and consequently easier angles, of the former compared with those of the work result in sufficiently uniform feed even on the most acute angles. The cam face is very wide and in most cases the roller is many times larger than the cutter, giving a rigid support during operation.

Produces Its Own Master Formers

To produce the cam or former, the roller is removed and a milling cutter *A* is inserted in its place, as shown in Fig. 2. This cutter is the same size as the roller which is to be used, is driven from the main shaft and may be adjusted vertically to permit the taking of several cuts when necessary. A model of the work is then put in its predetermined place on the fixture and a former-pin, the same size as the cutter to be used, is inserted in the cutter spindle *D*. The mechanism for driving the cam-cutter *A* is independent of the drive for the spindles, consequently the former pin does not rotate while the cam is being cut.

During the cam-cutting operation, the weights *C* are placed at the right of the machine, as shown in Fig. 2, to hold the model against the former-pin. The force of the cut also tends to keep the model in contact with the former-pin. It has been found good practice to take several roughing and one finishing cut when making the cams. The power feed is, of course, used when cams are being cut.

The Spindles and Adjustments

The machine is regularly provided with two spindles, one roughing and one finishing, six inches, center to center, provided with Jarno No. 7 taper hole. The spindles are hardened and are driven by spiral gearing. The gears rotate in oil-tight bearings which revolve on their own journals and do not cause any side thrust to the spindles. The spindles are balanced and have four inches vertical adjustment. Three speeds are provided, 716, 478 and 318 revolutions per minute.

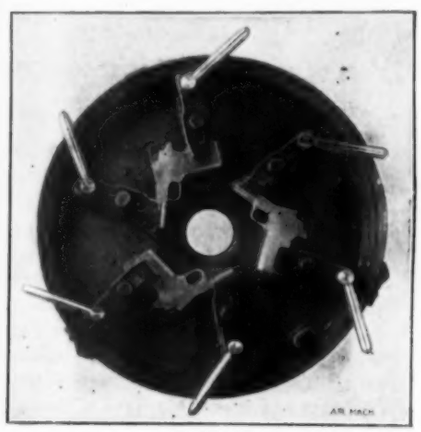


Fig. 5. The Work-holding Fixtures

The head is adjustable horizontally on the crossrail. The center distance between the spindle and the guide roller is variable from 3½ to 9 in. Micrometer stops *F*, Fig. 4, are provided for both the vertical and horizontal movements.

The Work

In Colt's Armory, Hartford, Conn., a number of these machines have been installed. A sample automatic pistol frame of 0.40 carbon steel profiled on them is shown in Fig. 3. The blanks are clamped

three or four at a time in the fixture, as shown in Figs. 4 and 5. The cut along the under part of the barrel, trigger-guard and inside of the grip, shown in Fig. 5, is about seven inches in length; that is to say, on the three pieces about 21 inches. It takes about 4½ minutes for the cut to run over the three pieces, or about 12½ minutes for roughing, finishing and reloading the fixtures.

About 90 pistol frames of this character are finished per machine in nine hours. The other cuts are shorter and 100 frames can, on these shorter cuts, be finished per nine hours per machine. The cutters are high-speed steel and retain their sharpness remarkably well when compared with cutters used in hand profilers. This is probably due to the uniformity of the feed. The roughing cut is about 3/64 in. and the finishing cut from 1/64 to 1/32 in.; the limits are very close.

The machine is regularly equipped with oil pumps, tank and piping, double friction countershaft and a set of wrenches. The fixtures are built to order only. The maximum working surface of the fixture is 16 in. diameter. The maximum and minimum cam-diameters are 26 and 15 in., respectively. The maximum throw of the cam with 2-in. roll is 2½ inches.

The maximum distance from the top of the table to the end of the spindle is 7⅝ in., and the minimum 3⅝ in. Table, top to bottom of cross-slide, 7⅝ in. Maximum distance, center of table to center of spindle, 8 in., minimum 0. The machine occupies a space 53x59 in., and weighs 3700 lb.

Practical Experience for Engineering Students

By Charles F. Scott*

"The establishment of apprenticeship courses for engineering graduates is an acknowledgment that the output of our engineering schools is unsatisfactory." Is this statement, recently made by an engineering educator, really true? I believe not, if it implies that "satisfactory" graduates would make such courses unnecessary. On the contrary, the technical graduate has come into general favor because he is no longer expected to be a trained practical expert when he gets his diploma, but is presumed to have a preliminary training which will enable him to acquire readily the special training and the practical experience needed in his chosen profession. There is a great deal in the industries, which they themselves must furnish, which it is not only impracticable for the technical schools to supply, but which it is not their function to furnish. Their function is to make good beginners and the specialized training upon which the vitality and development of an industry depend must be fostered within the industry itself. Hence, the post-graduate course in the world's workshop is normal and proper—a logical supplement to the technical school and not a reflection upon its efficiency.

Coöperative systems of various kinds are being provided, by which students may acquire practical experience before the completion of their school work. One of the latest examples is at the University of Pittsburg, which provides several periods, each of a few months, during the sophomore and junior years which the student spends as a workman in the industries of the Pittsburg district. The great value of this system is not that the student's technical knowledge is increased in a big practical laboratory, but that it helps to make him a better beginner after graduation. A present difficulty with many graduates is that they have so long breathed the atmosphere of the school, where the purpose of everybody is to teach them something, that they catch pneumonia in the chilly surroundings of real life, where they are expected to do something for somebody else. Then there is also the seriousness of doing one thing nine or ten hours a day, week after week, instead of taking half a dozen subjects at a time in hourly doses along with as many more varied outside interests. The transition will be much easier, the graduate will be a much better beginner, if he has breathed factory air and responded to the seven-o'clock whistle in earlier years.

Many students learn what is in the book, but do not comprehend the real, physical thing. The formula is the thing they feel familiar with; the phenomenon is something which is explained by the formula. One of the hardest tasks of the teacher is to counteract this tendency and lead the pupil to think and feel nature's laws for himself. Formulas then become merely a convenient shorthand method of expressing them, worthy of no more reverence than the stenographer's notes of a great speech. Just as judicious laboratory exercises give definite meaning to what may otherwise be hopelessly vague and abstract, so judicious workshop and other practical experience may give definite meaning to the whole college life, making clear the rational purpose of its training in fundamental things, affording an intelligent insight into the relations between the college world and the larger world, and inspiring a new and concrete interest in one's studies as he appreciates that the college course itself is a sort of formula which stands for the things in serious, practical life. This new attitude of the student to the later years of the college work is one of the best features of the coöperative method.

Factory work will bring out clearly the serious and to some students the disappointing fact that the manufacturer is not running a shop school, but a business proposition and that they are likely to acquire more in the way of general discipline than of technical information. And it is well that this is so, for more graduates fail for lack of the ability to get along efficiently with other people than for lack of technical knowledge. Hence the value of the experience and the new point of view which early contact with workingmen and with real things are apt to give.

When the employers of graduates say they are "unsatisfactory," it is usually not because they are not full-fledged engineers, but it is because they are not good beginners, and coöperative methods may be made an effective means of supplying some of their important deficiencies.—*Electric Journal.*

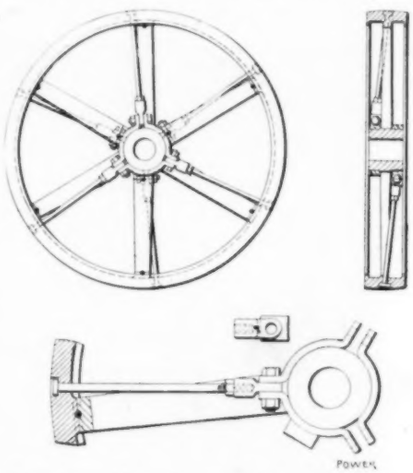
*Professor of electrical engineering, Sheffield Scientific School.

A Flywheel Repair

By Joseph E. Pelum

The engine carrying this wheel was equipped with a ball governor having no automatic stop. The governor belt broke and permitted the engine to run away and break the wheel.

Five of the six spokes broke at the rim and at the hub, but the remaining spoke broke at the rim only.



Showing Manner of Repairing Flywheel

The accompanying figure illustrates the manner in which the wheel was repaired.

This wheel was repaired six months ago and has been giving satisfaction ever since. When it is taken into consideration that this engine runs almost 24 hours a day, it is reasonable to assume that the repair will last as long as the engine.

The ⅞-in. studs shown in the cracks were put in and riveted to prevent the arms from "walking" out of position.

Fire losses and the cost of fire prevention in the United States amount annually to $450,000,000, or more than the total American production of gold, silver, copper and petroleum in a year.

Machining Venturi Meter Parts

By Dana W. Pond*

An interesting account of the methods used to finish parts of unusual size, intended for the meters to be placed in the Catskill Aqueduct by the City of New York.

*Superintendent, Builders' Iron Foundry.

The machining of large pieces on small machines is sometimes necessary in a shop where the job is not likely to occur frequently enough to warrant the purchase of large tools. Such an increase occurred in the shop of the Builders' Iron Foundry, Providence, R. I., not long since.

This shop for some years has been engaged in the manufacture of the Venturi water meter, which, in the larger sizes, ranges from 36 to 60 in., and even up to 102 in. in diameter, the largest, however, up to this writing, being the three tubes for the Catskill Aqueduct. Of these tubes one is 17 ft. and the other two 17 ft. 6 in. in diameter.

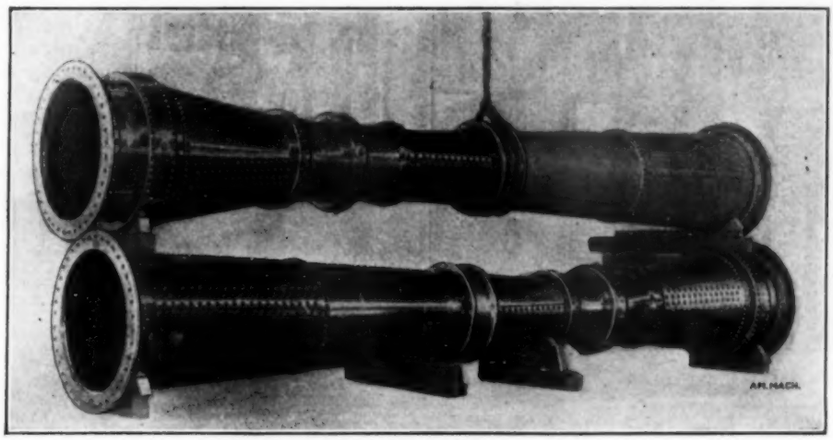


FIG. 1. MAIN TUBES FOR VENTURI METERS

The Venturi meter consists of a pipe or tube containing a restricted portion near the middle called the throat, the tube being gradually tapered from both ends to meet the throat, as shown in Fig. 1.

There is an annular chamber surrounding the tube on the upstream end, into which water is admitted through small radial holes, and another similar device is placed at the throat or smallest diameter of the tube, as shown in Fig. 2. At both of these chambers it will be noted are tapped holes on the outside, into which are screwed pipes, which in turn connect with the measuring instrument.

As the water flows through the tube there is a marked decrease of pressure at the throat, due to the more rapid flow at that point, while the pressure both above and below the throat remains nearly the same, and the difference in the pressure between the upstream and throat chambers bears a fixed relation to the rate of flow, and this difference in pressure is transmitted to a distant recording and registering instrument, which shows both the rate and the amount of water passing through the tube.

The parts of these tubes manufactured at our shop were the upstream pressure chambers and the throats, one of each being shown in Figs. 3 and 4, respectively, the conduit itself being of concrete construction, built in place.

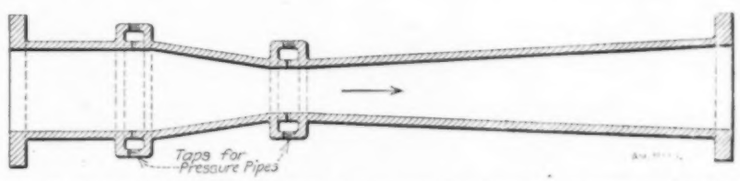


FIG. 2. SECTIONAL VIEW OF METER, SHOWING PLACING OF PRESSURE CHAMBERS

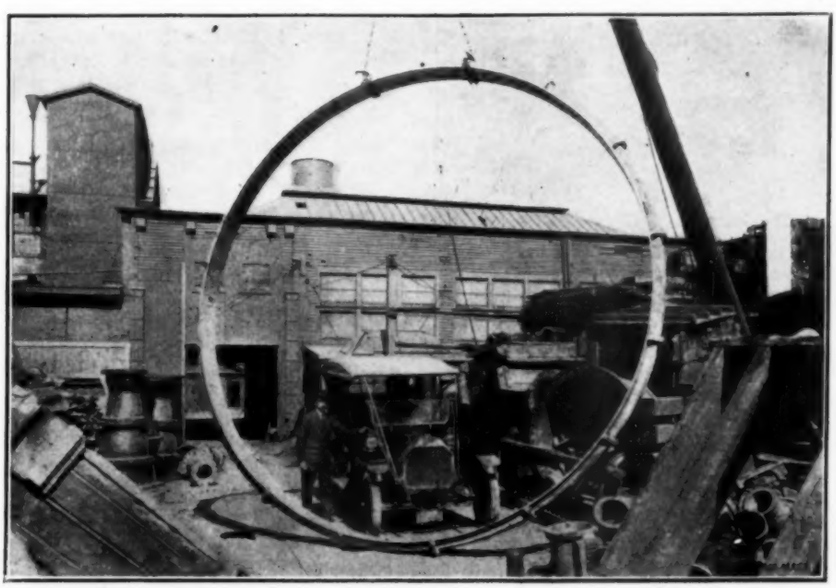


FIG. 3. UPSTREAM PRESSURE CHAMBER

MACHINING THE UPSTREAM CHAMBER

The upstream chamber, as may be seen, is a ring composed of 16 segments bolted together, and the first operation on the rough castings was the grinding of the edges, which was done on an 84-in. face grinder, built by the Diamond Machine Co., the time consumed being about six minutes for each piece. The next operation was the finishing of the ends, which was done by clamping the segments on a planer in a string, setting the heads to the proper angle—in this case 11¼ deg.—and facing down, of course, taking care to make the chord measurement enough short to allow for the finishing of the inside.

As there was no lathe or boring mill large enough to bore this ring, the inside of the segments was machined on a slotter, using a radius bar placed as shown in Fig. 5, the transverse feed and tangent screws being removed to allow

the table to swing as the work was fed to the tool.

A little calculation shows that the chord of the arc for each segment should be 40.969 in., so the inside of each was finished to this measurement, and though extreme accuracy as to diameter was not necessary, when the finished segments were bolted together, the variation in diameter of the ring at various points amounted to less than $\frac{1}{16}$ inch.

FIG. 4. THROAT AND PRESSURE CHAMBER

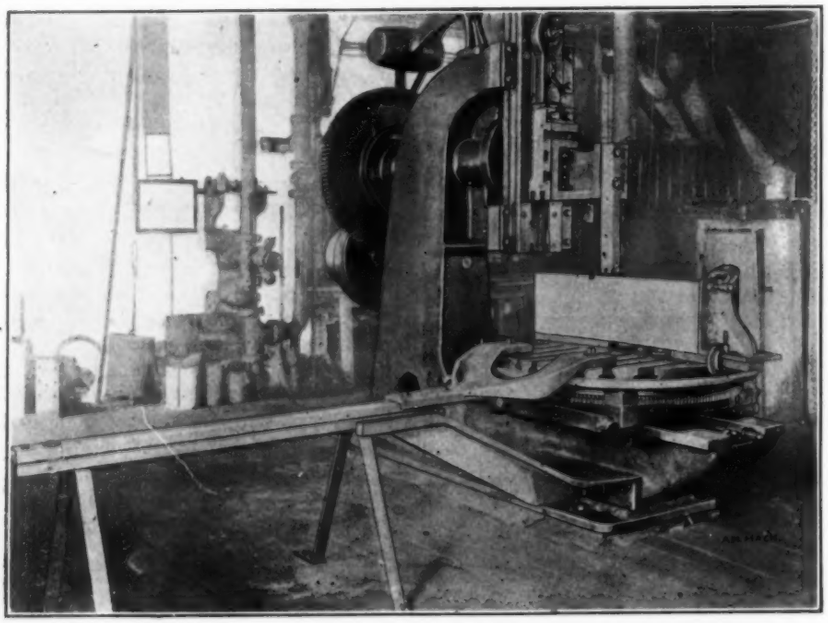


FIG. 5. RADIUS ATTACHMENT FOR SLOTTER USED TO FINISH INSIDE OF SEGMENTS

FACING AND BORING THE THROATS

The throats were made in two sections, the smallest internal diameter being 93 in., and these had to be bored the entire length and the flanges faced. An 84-in. Sellers mill was the largest machine available, so the housings and rail were removed from this, leaving only the base casting and the table. Four brackets of gray iron, *A*, *B*, *C* and *D*, Fig. 6, were bolted to the base, extending radially far enough to receive the meter castings, which were in turn securely bolted to them.

As the back gearing was in the way it was removed and the shaft lengthened to bring the drive outside of the tube casting. A pillow block of gray iron, bolted to the floor, carried the cone and back gears, as shown at *E*, an electric motor completing the drive. A special column *F*, carrying a slide that could be thrown over to bore on a taper, was made and secured to the table of the mill, as shown. While facing the flanges a boy on the inside furnished the feed by turning the handle *G*, and while boring, a star on the vertical screw, fed the tool to the cut.

The vertical slide on the column is simply a rectangular bar of gray iron, secured to the face by means of four bolts passing through slotted holes and swinging on a center pin, to allow swinging out of a vertical position to bore a taper hole. The transverse slide is a bar of 4-in. round, machine steel working in a plain bored hole and advanced to its cut by a screw in the same manner as the tail spindle of a lathe, the cutting tools being pieces of 1-in. round steel, inserted in holes in the end of the bar.

The quality of the work done was excellent, and the entire expense of rigging the mill and putting it back in shape was much less than what it would have cost to transport the pieces to some shop where there was a mill big enough to have handled them.

The Machine Designer

BY R. P. TAIT

The man who designs machinery is a type all by himself, and he must possess a certain number of special qualities. The results of his work are as much affected by his personal qualities as by the amount of stored-up knowledge which he has at his disposition. I would almost say that the first are of more importance, because if the personal characteristics are present, then knowledge will be acquired naturally. He should be a broad-minded man, and have a clear mind under perfect control. He must be able to concentrate his mind on a single subject to a much higher degree than the average man.

ESSENTIALS OF DESIGN

Simplicity in construction is the real touchstone to successful designing, and this very simplicity should be the mirror of the designer's mind. Simplicity and honesty are the only qualities that will stand in machine design.

As a matter of fact one can readily recognize the design of a certain man if one knows his character and his way of looking upon things. The lines of the castings, the proportions of the bearings, and the arrangement of the moving parts one to another, imediately give us a certain kind of impression, either of satisfaction, rest and confidence, or else the machine will give us the impression of a mixup of ideas scraped together by little bits at a time and added to one

another, the whole making a construction which is out of proportion. The designer in this case did not have the necessary broad-minded view of the whole piece of mechanism. His mind is one which easily scatters and which is too easily satisfied. This kind of a man will not accept honest criticism. He thinks it is given to hurt his feelings. He is the narrow-minded man, not able to forget himself for the benefit of his work, and therefore he is the unsuccessful designer. This man will rush into the construction of a machine and have no patience to try certain important parts before spending a large amount of money for the whole machine; and during all this time the scrap heap, the uncanny monster, is smiling in anticipation of what is coming.

Personal Characteristics

The good designer of machinery should have a thorough knowledge of mechanics, and he will have it, for it is only natural that a well ordered mind should want satisfaction for the thousand and one questions that bother him while he is working. He is clever enough to talk things over with other men; he is not afraid to acknowledge ignorance.

Talking things over with others will lead sometimes to entirely unexpected results, surprising to both parties and setting them to wonder who was the one who started the thing going. The designer goes back to his work with a refreshed mind, which has received a new stimulus, and new channels and prospects are opened.

The successful designer is of an optimistic character. Once that he sets out to conquer a certain problem, he knows that he is going to do it. It may take some time, but he is sure of a successful solution in some way. The problem will come back to his mind again and again and at last it is so familiar to him that it seems to be part of his daily train of thought.

The Broad Principles

The first thing is to understand perfectly what is wanted and not to try for any solution until every requirement is clearly defined. Then in most cases this perfect understanding suggests the solution. We all know this from the time when we had to solve our mathematical problems in school. Formulas and short cuts are of no avail if we are not sure what they should lead to. The designer's imagination should be a strongly developed faculty. The real designer does not start with paper and pencil to work out his schemes; he sees the machine as it is going to be, and it is only after this mental study that he tries to make a preliminary sketch in order to record the idea.

Herewith we are able, to a certain extent, to see the designer of machinery as a man, and if we want to risk it, we may approach the question of "how to design machinery" as a natural outcome of what this man would do. However, we are at once confronted with the enormous variety of work, but for the present we shall try to attack the subject in a general way.

As pointed out above, the first thing in question is to realize the work the machine will have to perform. This, in most cases, will put in a certain class of machinery and to my view the best thing is to spend a little time (if so available) and make one's self familiar with what exists in this line. This will help to avoid patent infringements from the start and at the same time gives the opportunity to settle on the type of machine, even when the mechanism has to be designed in some new, original way.

A talk with operators of the existing machines will bring out the weak points and avoid many stumbling blocks. At the same time it gives us a chance to improve and go them one better in our own design.

After this the performance of the machine should be split up in separate operations, some of which may be combined later on.

This divides the machine into units, which can be worked out as mechanism, each performing its specific duty. Now it is time to settle on the range and size necessary to suit the desired articles to be made on this machine and a rough pencil sketch or diagram, with mechanism shown in a crude way, will record the mental idea which the designer has been working out ever since he began to be interested in this machine.

Useless to say that in some cases the working out on paper will bring out totally different ideas from those with which the designer originally started. Here the stored-up mechanical knowledge and judgment begin to come in.

Now, however, suppose no earlier machines are to be found. Again we analyze the separate operations and we will naturally begin to consider what we would do making the desired article by hand and with which tools. We will then soon find mechanisms to replace our hand movements and we have to keep at it, improving on same as much as we can, using our utmost inventive ability to simplify wherever possible, and by and by we will be so far that we really see a machine with complex movements for the separate operations.

To go further, details would lead us to special cases and beyond the scope of this article.

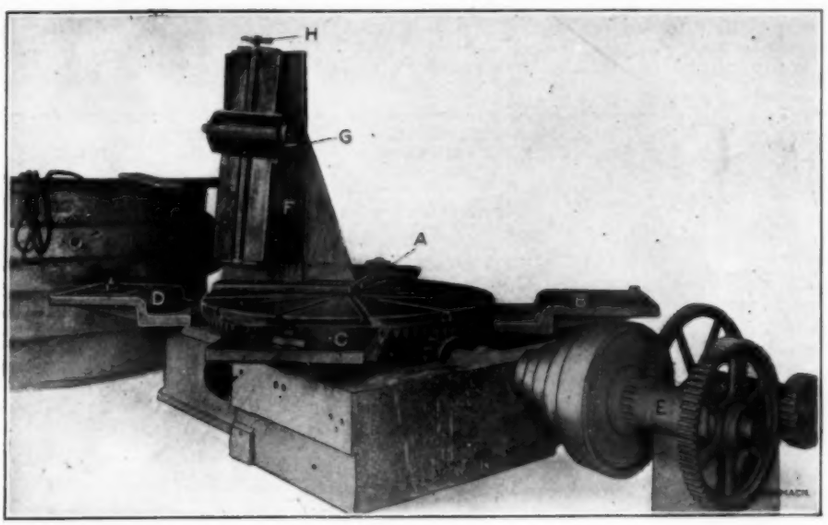


Fig. 6. Seller's Boring Mill Arranged for Boring and Facing Throat Section

Diplomacy an Essential

There is one quality left which we expect to find in the designer of machinery, although we could almost say it is included in the foregoing. He should have a certain basis of what we call common sense. This will help him to get along with people of all kinds and they all have to be approached in different ways.

He has to communicate his views to his superiors and the adoption of his design which cost him so much labor and which he really believes to be good, depends on the way he presents it to them. A refusal to accept his design may depend entirely upon the character of these superiors or of the man who takes care of the financial end, and I am sure the real designer would rather lose the well merited credit for his work than to see it put on the shelf. It is the love for his own creation. Fortunately these cases are rare.

In making brass castings, it is necessary always to melt the coarsest material and that having the highest melting point first. After this material has become molten, add the more volatile or easily oxidized constituents.

Operation Sheets for Turret Work

By F. Hoder*

A method of recording the tools used, the proper setting of them and working data for each job handled, which saves much valuable time in the set up and operation.

*Mechanical engineer, Otto Gas Engine Co.

What are known as operation lists were recently devised to be used in connection with Pond turret lathes, Gridley, Potter & Johnston, and Cleveland automatics.

When a new piece of work was to be finished the machine was set up to do the job, and then an operation list was written up. This sheet contains the entire data for setting up the machine again for the same job. Before this list was devised it was either a case of memory on the part of the workman, or the foreman had to figure out the entire arrangement all over again.

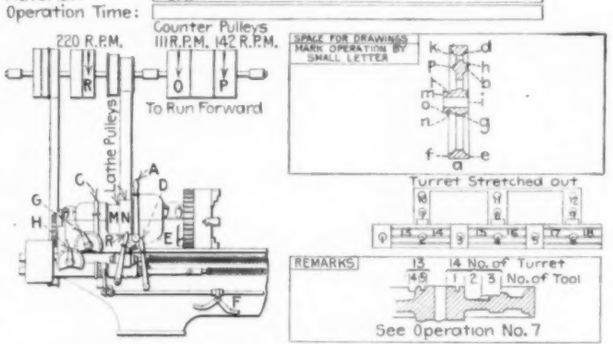
Fig. 1 shows the list for the Pond machine, giving the operations and tool arrangement for machining a flywheel. A clear sketch of the machine shows every lever, pulley and stop on the machine and countershaft, each being numbered or lettered, while to the right is shown a developed view of the turret. Each tool hole is numbered, and a space is left for a drawing of the piece to be machined, which has each operation marked on it with a small letter. A space is also left on the sheet where sketches of complicated tools or other things may be made. In the table each operation is designated by the letter marked on the drawing, columns being provided for number and location of tools, speeds, feeds and remarks.

The sheet used for a Potter & Johnston automatic is shown in Fig. 2. Dimensions *C*, *D* and *E* locate the position of the piece to be finished and also the position of the tools *A* and *B* on the cross slide. The holes in the turret are numbered and the dimensions *F*, *G*, *H*, *J*, *K* and *L* show the length of the extending tools. The slots on the feed-shifter disk are numbered and the outside of the disk is graduated in degrees, whereby the working-feed dog and the quick-advance dog can be located by the data in the table. The slots in the speed and feed camdrum are numbered and dimensions *X* given to assure the proper extension of the cam.

Fig. 3 shows the arrangement for a Cleveland machine, the plan view giving the working parts. The tool posts on the cross slide are lettered and a table provided for the number of tools used in each. The holes in the turret are numbered and the number of the tool in each

OPERATION LIST AND TOOL ARRANGEMENT OF 28" POND TURRET LATHE, MACH. No. 116

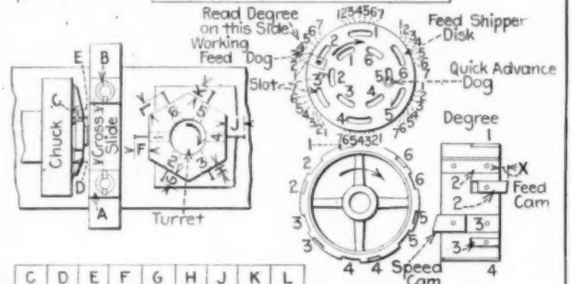
Name of Piece: Flywheel A4
Piece Number: 3412
Material: C. I.
Operation Time:



NO. OF OPER.	KIND OF OPERATION	OPER. IND'D BY LETTER	TOOLS NAME OR No. OF TOOL	TOOLS LOCATION	FACE PLATE SPEED BELT ON COUNT. PULLEY	FACE PLATE SPEED BELT ON LATHE PULLEY	FEED LEVER A	FEED LEVER B	FEED LEVER C	FEED LEVER G	FEED LEVER H	REMARK NO. 2
1	Roughing	a	L.H. Rough Tool	Tool Post	R	M	Vert.	Right	Right	2	2	
2	Rough Facing	e f	Combinat. Fac. Tool C 3	"	O	M	Right	Left	"	4	4	REMOVE TOOL FROM TOOL POST
3	" "	c	L.H. Rough Tool	"	R	M	"	"	"	3	4	
4	Roughing	b h	" " " "	"	R	M	"	"	"	3	4	
5	"	g	" " " "	"	R	M	"	"	"	3	4	
6	Rough and Finish	d	" " " "	"	O	M	"	"	"	3	4	
7	Drilling Finishing	k g l b	Core Drill 13 2 4-5-1	Turr. 2 " 5 4	R	M	"	"	"	3	4	SEE REMARK NO. 1
8	Finish Bore	i	Boring Bar BA 107	Turr 4	O	M	Left	"	"	3	4	LEAVE TOOL FOR REAMING
9	Finishing Reaming	a	Fin. Cutter F 804 1⅛ Std. Ream.	Turr. 2 " 6	O	M	Right	"	"	2	2	
10	Finishing	e f	Combinat. Fac. Tool C. P. 173	Tool Post	R	M	"	"	"	Hand Feed		REMOVE TOOL FROM " POST
11	Roughing and Finishing	k l m p	L.H. Rough Tool	"	R	M	"	"	"	3	4	
12	Cutting Groove	n	Grooving Tool X 750	"	R	M	"	"	"	Hand Feed		
13	Rounding Hub	o	Fillet Tool X 751	"	R	M	"	"	"	"	"	

1ST. OPERATION LIST AND TOOL ARRANGEMENT FOR POTTER AND JOHNSTON, AUTOMATIC MACH. No. 111

Name of Piece: C4 Spiral Gear
Piece Number: 13504
Material: C. I.
Operation Time:



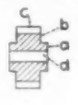
C	D	E	F	G	H	J	K	L
3½	3 11/32	3 21/64	4 11/16	4 23/64	6 3/4	5 3/4	5 3/4	

NO. OF OPER.	KIND OF OPERATION	OPER. IND'D BY LETTER	NAME OR NO. OF TOOL	TOOL HOLDER NO.	WORKING FEED DOG SLOT NO.	WORKING FEED DOG DEG.	QUICK ADV. DOG IN SLOT NO.	SPEED	FEED CAM CAM No.	FEED CAM X
1	Rough Boring " Facing	d a	B 116 C 23	F¹	1	4	1	MEDIUM	–	–
2	Finish Boring " Facing	d a	B 117 C 24	F²	2	4	2	"	–	–
3	Reaming	d	2 3/8 Reamer	R¹	3	–	3	"	–	–
4	Rough Turning " Facing	c b	T 420 Armst. 4	T¹	4	4½	4	"	–	–
5	Finish Turning " Facing	c b	T 422 Armst. 5	T²	5	4½	5	"	–	–

STROKE OF TURRET SLIDE 11

REMARK Chuck Jaws 13504

SPACE FOR DRAWING OF THE FINISHED PIECE



AM. MACH.

FIG. 1. OPERATION LISTS AND TOOL ARRANGEMENT FOR 28-IN. POND TURRET LATHE AND POTTER & JOHNSTON AUTOMATIC FIG. 2

put in the table. The four rows of tap holes in the cross-slide drum are also numbered, which enables the cams to be located by the table. Spaces are provided for remarks and drawings of the finished piece.

The Gridley layout is shown in Fig. 4, and only those parts of the machine which are changed for each job are drawn. The feed cam drum shown on the left has two rows of tap holes, each hole of which is numbered, and by this means the cams can be placed and adjusted by the dimensions *A* and *B*, which are the distances from the centers of the tap holes to the edges of the counterbore.

In the forming and cutting-off cam disk to the right are 38 tap holes, which are also numbered, and it is by these numbers the forming and cutting-off cams are located and then adjusted by the dimensions *C*. The tool slides are numbered and the dimensions *D* and *E* show the location of tools and stops. In the tables are written the data for each job; also a drawing of the piece is placed in the space for remarks.

A Straddle Milling Jig

By S. Victor Brooks

The part *A* in the cut is a steel casting for an automobile brake band clip and the first operation in its machining is straddle milling the ears with a gang of three mills, which is done while the casting is held in the jig shown.

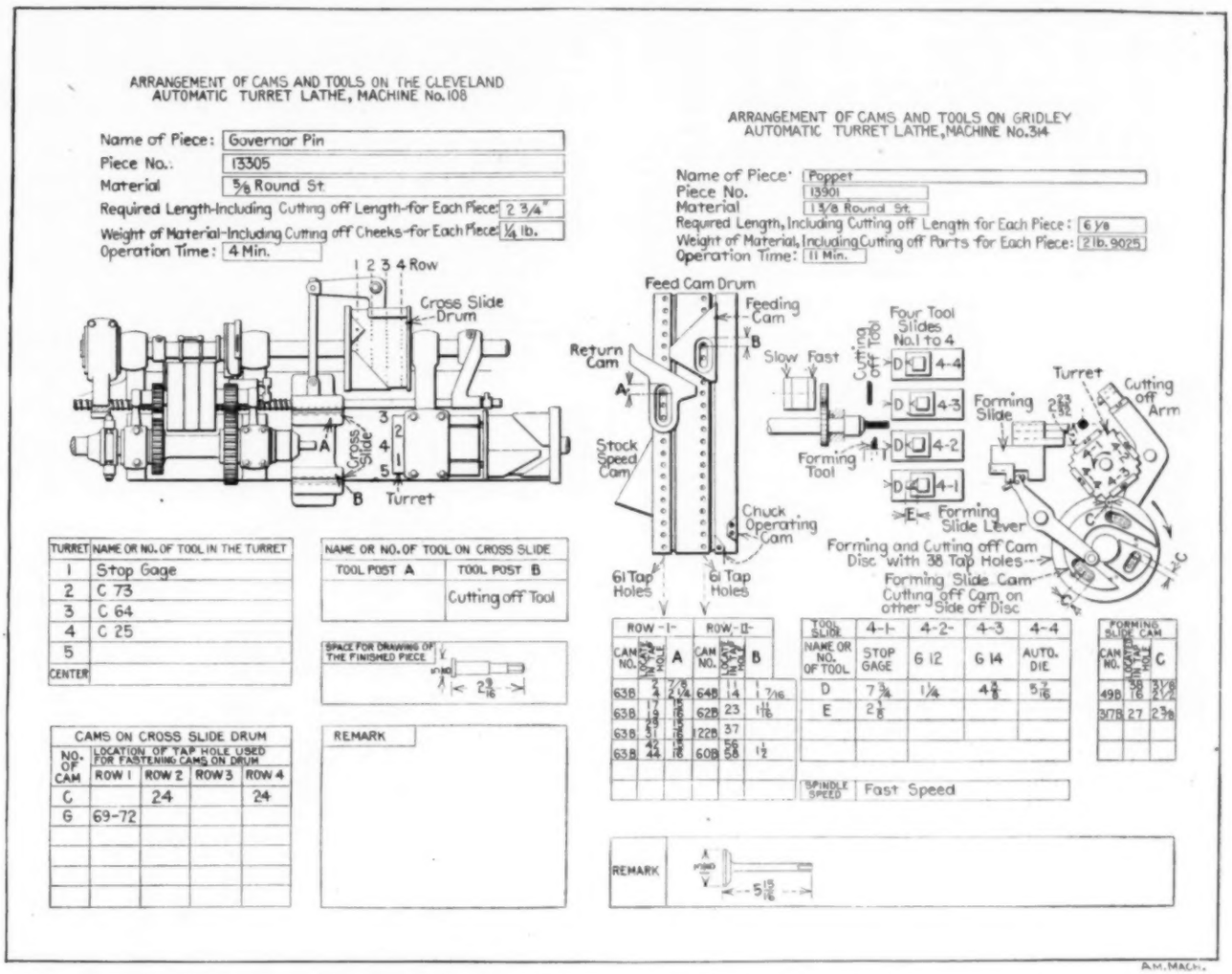
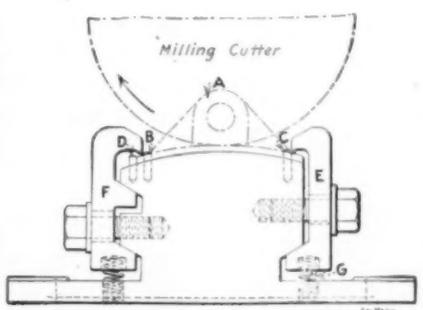

ARRANGEMENT OF CAMS AND TOOLS ON THE CLEVELAND AUTOMATIC TURRET LATHE, MACHINE No. 108
Name of Piece: Governor Pin
Piece No.: 13305
Material: 5/8 Round St.
Required Length-Including Cutting off Length-for Each Piece: 2 3/4"
Weight of Material-Including Cutting off Cheeks-for Each Piece: 1/4 lb.
Operation Time: 4 Min.
1 2 3 4 Row
Cross Slide Drum
Cross Slide
Turret
TURRET | NAME OR NO. OF TOOL IN THE TURRET
1 Stop Gage
2 C 73
3 C 64
4 C 25
5
CENTER
NAME OR NO. OF TOOL ON CROSS SLIDE
TOOL POST A | TOOL POST B
Cutting off Tool
SPACE FOR DRAWING OF THE FINISHED PIECE
CAMS ON CROSS SLIDE DRUM
NO. OF CAM | LOCATION OF TAP HOLE USED FOR FASTENING CAMS ON DRUM
ROW 1 | ROW 2 | ROW 3 | ROW 4
C 24 24
G 69-72
REMARK
ARRANGEMENT OF CAMS AND TOOLS ON GRIDLEY AUTOMATIC TURRET LATHE, MACHINE No. 314
Name of Piece: Poppet
Piece No. 13901
Material 1 3/8 Round St.
Required Length, Including Cutting off Length for Each Piece: 6 1/8
Weight of Material, Including Cutting off Parts for Each Piece: 2 lb. 9025
Operation Time: 11 Min.
Feed Cam Drum
Feeding Cam
Return Cam
Slow Fast
Cutting off Tool
Four Tool Slides No. 1 to 4
Turret
Cutting off Arm
Forming Slide
Stock Speed Cam
Forming Tool
Forming Slide Lever
Chuck Operating Cam
Forming and Cutting off Cam Disc with 38 Tap Holes
Forming Slide Cam Cutting off Cam on other Side of Disc
61 Tap Holes
61 Tap Holes
ROW-I- | ROW-II-
CAM NO. | A | CAM NO. | B
638 | 2 | 7/8 | 64B | 1 1/4 | 1 7/16
638 | 17 | 1 5/8 | 62B | 23 | 1 1/16
638 | 19 | 1 5/8 | 122B | 37 | 1 1/2
638 | 31 | 1 5/8 | 60B | 56 | 1 1/2
638 | 42 | 1 5/8 | 58
638 | 44
TOOL SLIDE | 4-1- | 4-2- | 4-3 | 4-4
NAME OR NO. OF TOOL | STOP GAGE | G 12 | G 14 | AUTO. DIE
D | 7 3/4 | 1 1/4 | 4 1/8 | 5 7/16
E | 2 1/8
SPINDLE SPEED | Fast Speed
FORMING SLIDE CAM
CAM NO. | C
49B | 5/8 | 3 1/8
16 | 2 1/2
37B | 27 | 2 3/8
REMARK
A.M. MACH.

FIG. 3 OPERATION SHEETS FOR CLEVELAND AND GRIDLEY AUTOMATICS FIG. 4



A STRADDLE MILLING JIG

The body of the jig is of cast steel; cast iron could have been used but the wear from the sliding clamps would be excessive unless steel bearing points were inserted. The top of the jig is finished to the same radius as the inside of the brake clip. Two pins *B* and *C* are inserted to slide the clip against and the pins *D* are for taking any thrust from the milling cutters that is not overcome by friction from the thrust of the clamps.

In placing a clip in position clamp *E* is tightened first, which not only draws the clip downward but exerts a slight pressure in the direction of the pins *D*, while clamp *F* draws chiefly in a downward direction. The springs, *G* help hold the clamps up when there is no clip in place. Both clamps are made of hardened tool steel.

The Delray boilers, with their 23,654 sq.ft. of effective heating surface and over 400 sq.ft. of grate, are the largest stationary boilers in the world. An interesting comparison is the record-breaking locomotive just built for the Pennsylvania R.R. With 7723.6 sq.ft. of heating surface and 96 sq.ft. of grate this immense boiler on wheels will generate nearly as much steam as the stationary boiler at its normal rating.

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 48 TEETH

No. Teeth in Mating Gear	Outside Diameter	Apex Distance	Center Angle and Angle of Edge	Face Angle	Cutting Angle	Geometrical Pitch Circle Radius at Large End of Tooth	Geometrical Number of Teeth for Selecting Cutter	Ratio of Gear to its Mate. Geometrical Pitch Circle Radius	Decrements for Each 1-inch Length of Gear Face of: Pitch Circle Radius	Addendum	Tooth Thickness
	Ins.	Ins.				Ins.			Ins.	Ins.	Ins.
12	48.485	24.738	75°58′	11°43′	73°39′	98.975	197.95	4.0000	.9702	.0404	.0635
13	48.523	24.864	74 51	12 51	72 33	91.831	183.66	3.6923	.9652	.0402	.0632
14	48.560	25.001	73 44	13 59	71 27	85.681	171.36	3.4286	.9600	.0400	.0628
15	48.596	25.145	72 39	15 04	70 22	80.480	160.96	3.2000	.9545	.0398	.0625
16	48.632	25.298	71 34	16 10	69 18	75.901	151.80	3.0000	.9487	.0395	.0621
17	48.668	25.460	70 30	17 15	68 15	71.897	143.79	2.8235	.9426	.0393	.0617
18	48.702	25.631	69 27	18 19	67 13	68.372	136.74	2.6667	.9364	.0390	.0613
19	48.736	25.812	68 24	19 23	66 11	65.196	130.39	2.5263	.9298	.0387	.0608
20	48.769	25.999	67 23	20 25	65 11	62.410	124.82	2.4000	.9231	.0385	.0604
22	48.833	26.400	65 23	22 27	63 13	57.616	115.23	2.1818	.9091	.0379	.0595
24	48.894	26.833	63 26	24 26	61 18	53.662	107.32	2.0000	.8944	.0373	.0585
30	49.060	28.300	58 00	29 59	55 59	45.290	90.58	1.6000	.8480	.0353	.0555
32	49.109	28.842	56 19	31 42	54 20	43.274	86.55	1.5000	.8321	.0347	.0545
36	49.200	29.999	53 08	34 57	51 13	40.003	80.01	1.3333	.8000	.0333	.0524
40	49.280	31.239	50 12	37 58	48 22	37.494	74.99	1.2000	.7683	.0320	.0503
48	49.414	33.941	45 00	43 19	43 19	33.941	67.88	1.0000	.7071	.0295	.0463
60	49.562	38.422	38 40	49 51	37 11	30.738	61.48	.8000	.6248	.0260	.0409
72	49.664	43.263	33 41	55 00	32 22	28.842	57.68	.6667	.5546	.0231	.0363
84	49.736	48.376	29 45	59 04	28 34	27.643	55.29	.5714	.4962	.0207	.0325
96	49.789	53.666	26 34	62 22	25 30	26.833	53.67	.5000	.4472	.0186	.0293
108	49.828	59.095	23 58	65 04	23 00	26.264	52.53	.4444	.4062	.0169	.0266
120	49.857	64.621	21 48	67 19	20 55	25.848	51.70	.4000	.3714	.0155	.0243

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 49 TEETH

12	49.476	25.225	76 14	11 30	73 58	102.954	205.91	4.0833	.9713	.0396	.0623
13	49.513	25.348	75 08	12 36	72 52	95.490	190.98	3.7692	.9665	.0394	.0620
14	49.550	25.481	74 03	13 42	71 48	89.156	178.31	3.5000	.9615	.0392	.0616
15	49.585	25.622	72 59	14 47	70 45	83.718	167.44	3.2667	.9562	.0390	.0613
16	49.621	25.773	71 55	15 52	69 42	78.930	157.86	3.0625	.9506	.0388	.0609
21	49.788	26.655	66 48	21 03	64 39	62.192	124.38	2.3333	.9191	.0375	.0589
28	49.992	28.219	60 15	27 43	58 13	49.373	98.75	1.7500	.8682	.0354	.0557

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 50 TEETH

12	50.467	25.710	76 30	11 16	74 16	107.089	214.18	4.1667	.9724	.0389	.0611
13	50.503	25.830	75 26	12 21	73 13	99.399	198.80	3.8462	.9679	.0387	.0608
14	50.540	25.962	74 21	13 27	72 09	92.675	185.35	3.5714	.9629	.0385	.0605
15	50.575	26.101	73 18	14 30	71 06	86.999	174.00	3.3333	.9578	.0383	.0602
16	50.610	26.249	72 15	15 34	70 04	82.005	164.01	3.1250	.9524	.0381	.0598
17	50.644	26.406	71 13	16 37	69 03	77.642	155.28	2.9412	.9467	.0379	.0595
18	50.677	26.571	70 12	17 39	68 03	73.800	147.60	2.7778	.9409	.0376	.0591
19	50.710	26.743	69 12	18 40	67 04	70.401	140.80	2.6316	.9348	.0374	.0587
20	50.743	26.925	68 12	19 40	66 04	67.318	134.64	2.5000	.9285	.0371	.0583
25	50.894	27.951	63 26	24 31	61 23	55.898	111.80	2.0000	.8944	.0358	.0562
40	51.250	32.019	51 20	36 53	49 33	40.013	80.03	1.2500	.7808	.0312	.0491
50	51.414	35.355	45 00	43 23	43 23	35.355	70.71	1.0000	.7071	.0283	.0444

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 51 TEETH

17	51.632	26.879	71 34	16 18	69 26	80.645	161.29	3.0000	.9487	.0372	.0584

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 52 TEETH

12	52.450	26.684	77°00	10°51	74°51	115.58	231.16	4.3333	.9744	.0375	.0589
13	52.485	26.800	75 58	11 54	73 50	107.22	214.44	4.0000	.9701	.0373	.0586
14	52.520	26.926	74 56	12 56	72 48	100.02	200.04	3.7143	.9656	.0371	.0583
15	52.554	27.059	73 55	13 58	71 48	93.85	187.70	3.4667	.9609	.0370	.0580
16	52.588	27.202	72 54	15 00	70 48	88.42	176.84	3.2500	.9558	.0368	.0577
17	52.621	27.354	71 54	16 00	69 48	83.69	167.38	3.0588	.9505	.0366	.0574
18	52.654	27.515	70 54	17 01	68 49	79.46	158.92	2.8889	.9449	.0363	.0571
19	52.686	27.680	69 56	18 00	67 52	75.78	151.56	2.7368	.9393	.0361	.0567
20	52.718	27.856	68 58	18 59	66 55	72.44	144.88	2.6000	.9334	.0359	.0564
26	52.894	29.069	63 26	24 36	61 28	58.13	116.26	2.0000	.8944	.0344	.0540
52	53.414	36.769	45 00	43 27	43 27	36.77	73.54	1.0000	.7071	.0272	.0427

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 54 TEETH

12	54.434	27.659	77 28	10 28	75 24	124.42	248.84	4.5000	.9762	.0361	.0568
13	54.468	27.771	76 28	11 28	74 24	115.38	230.76	4.1538	.9722	.0360	.0566
14	54.502	27.893	75 28	12 29	73 25	107.60	215.20	3.8571	.9680	.0358	.0563
15	54.535	28.021	74 29	13 28	72 26	100.93	201.86	3.6000	.9635	.0357	.0561
16	54.568	28.160	73 30	14 28	71 28	95.06	190.12	3.3750	.9588	.0355	.0558
17	54.600	28.305	72 32	15 27	70 31	89.95	179.90	3.1765	.9539	.0353	.0555
18	54.632	28.460	71 34	16 25	69 33	85.39	170.78	3.0000	.9487	.0351	.0552
19	54.664	28.622	70 37	17 23	68 37	81.35	162.70	2.8421	.9433	.0349	.0549
20	54.694	28.791	69 41	18 20	67 42	77.76	155.52	2.7000	.9378	.0347	.0546
24	54.812	29.547	66 02	22 02	64 06	66.47	132.94	2.2500	.9138	.0338	.0532
27	54.894	30.187	63 26	24 40	61 32	60.37	120.74	2.0000	.8944	.0331	.0520
36	55.109	32.447	56 19	31 55	54 33	48.68	97.36	1.5000	.8321	.0308	.0484
54	55.414	38.184	45 00	43 30	43 30	38.18	76.36	1.0000	.7071	.0262	.0411

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 55 TEETH

22	55.743	29.618	68°12′	19°52′	66°16′	74.05	148.10	2.5000	.9285	.0338	.0530
25	55.828	30.209	65 33	22 33	63 39	66.44	132.88	2.2000	.9103	.0331	.0520
33	56.029	32.071	59 02	29 11	57 15	53.45	106.90	1.6667	.8575	.0312	.0490

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 56 TEETH

12	56.419	28.636	77 54	10 06	75 54	133.57	267.14	4.6667	.9778	.0349	.0548
13	56.452	28.744	76 56	11 04	74 56	123.85	247.70	4.3077	.9741	.0348	.0546
14	56.485	28.861	75 58	12 03	73 59	115.47	230.94	4.0000	.9701	.0346	.0544
15	56.518	28.988	75 00	13 01	73 01	108.18	216.36	3.7333	.9659	.0345	.0542
16	56.550	29.121	74 03	13 59	72 05	101.89	203.78	3.5000	.9615	.0343	.0539
17	56.581	29.261	73 07	14 56	71 10	96.41	192.82	3.2941	.9569	.0342	.0537
18	56.612	29.410	72 11	15 52	70 14	91.51	183.02	3.1111	.9520	.0340	.0534
19	56.642	29.566	71 16	16 48	69 20	87.18	174.36	2.9474	.9470	.0338	.0531
20	56.673	29.732	70 21	17 43	68 25	83.27	166.54	2.8000	.9418	.0336	.0528
21	56.702	29.903	69 27	18 38	67 32	79.77	159.54	2.6667	.9364	.0334	.0525
28	56.894	31.305	63 26	24 44	61 36	62.61	125.22	2.0000	.8944	.0319	.0502
32	56.992	32.251	60 15	27 58	58 28	56.43	112.86	1.7500	.8682	.0310	.0487
40	57.162	34.407	54 28	33 52	52 48	48.18	96.36	1.4000	.8138	.0291	.0456
56	57.414	39.598	45 00	43 33	43 33	39.60	79.20	1.0000	.7071	.0252	.0397

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 57 TEETH

19	57.632	30.042	71 34	16 32	69 40	90.13	180.26	3.0000	.9487	.0333	.0523

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 58 TEETH

12	58.405	29.614	78 19	9 45	76 23	143.21	286.42	4.8333	.9793	.0338	.0530
13	58.437	29.719	77 22	10 42	75 26	132.60	265.20	4.4615	.9758	.0336	.0529
14	58.469	29.832	76 26	11 39	74 31	123.63	247.26	4.1429	.9721	.0335	.0526
15	58.501	29.954	75 30	12 35	73 35	115.82	231.64	3.8667	.9681	.0334	.0524
16	58.532	30.082	74 35	13 31	72 41	109.09	218.18	3.6250	.9640	.0332	.0522
17	58.562	30.220	73 40	14 26	71 46	103.12	206.24	3.4118	.9596	.0331	.0520
18	58.593	30.363	72 46	15 21	70 53	97.89	195.78	3.2222	.9551	.0329	.0517
19	58.622	30.516	71 52	16 15	69 59	93.18	186.36	3.0526	.9503	.0328	.0515
20	58.652	30.677	70 58	17 10	69 06	88.92	177.84	2.9000	.9453	.0326	.0512
29	58.894	32.423	63 26	24 48	61 40	64.84	129.68	2.0000	.8944	.0308	.0484
58	59.414	41.012	45 00	43 36	43 36	41.01	82.02	1.0000	.7071	.0244	.0383

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 60 TEETH

12	60.392	30.595	78 41	9 27	76 49	152.88	305.76	5.0000	.9806	.0327	.0513
13	60.424	30.700	77 46	10 22	75 54	141.58	283.16	4.6154	.9773	.0326	.0512
14	60.454	30.805	76 52	11 16	75 00	132.03	264.06	4.2857	.9738	.0325	.0510
15	60.485	30.923	75 58	12 11	74 07	123.72	247.44	4.0000	.9701	.0323	.0508
16	60.515	31.048	75 04	13 05	73 13	116.42	232.84	3.7500	.9662	.0322	.0506
17	60.545	31.180	74 11	13 59	72 21	110.07	220.14	3.5294	.9621	.0321	.0504
18	60.575	31.321	73 18	14 52	71 28	104.40	208.80	3.3333	.9578	.0319	.0501
19	60.604	31.467	72 26	15 43	70 37	99.40	198.80	3.1579	.9534	.0318	.0499
20	60.632	31.623	71 34	16 37	69 45	94.88	189.76	3.0000	.9487	.0316	.0497
24	60.743	32.311	68 12	20 02	66 26	80.78	161.56	2.5000	.9285	.0309	.0486
25	60.769	32.499	67 23	20 51	65 37	78.01	156.02	2.4000	.9231	.0308	.0483
30	60.894	33.541	63 26	24 52	61 44	67.08	134.16	2.0000	.8944	.0298	.0468
36	61.029	34.987	59 02	29 20	57 24	58.30	116.60	1.6667	.8575	.0286	.0449
40	61.109	36.052	56 19	32 06	54 44	54.09	108.18	1.5000	.8321	.0277	.0436
48	61.250	38.422	51 20	37 11	49 51	48.02	96.04	1.2500	.7808	.0260	.0409
60	61.414	42.426	45°00′	43°39′	43°39′	42.426	84.85	1.0000	.7071	.0236	.0370
72	61.537	46.858	39 48	48 59	38 35	39.048	78.10	.8333	.6401	.0213	.0335
80	61.600	49.998	36 52	51 59	35 43	37.498	75.00	.7500	.5999	.0200	.0314
90	61.664	54.079	33 41	55 15	32 37	36.052	72.10	.6667	.5546	.0185	.0290
120	61.789	67.083	26 34	62 35	25 43	33.541	67.08	.5000	.4472	.0149	.0234

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 62 TEETH

12	62.380	31.575	79 03	9 08	77 14	163.20	326.40	5.1667	.9818	.0317	.0497
13	62.410	31.673	78 10	10 01	76 21	151.17	302.34	4.7692	.9787	.0316	.0496
14	62.440	31.780	77 16	10 55	75 29	140.82	281.64	4.4286	.9755	.0315	.0494
15	62.470	31.894	76 24	11 48	74 36	131.84	263.68	4.1333	.9720	.0313	.0493
16	62.500	32.015	75 32	12 41	73 45	124.09	248.18	3.8750	.9683	.0312	.0491
17	62.529	32.144	74 40	13 33	72 53	117.23	234.46	3.6471	.9644	.0311	.0489
18	62.557	32.279	73 49	14 25	72 03	111.23	222.46	3.4444	.9604	.0310	.0487
19	62.586	32.422	72 58	15 16	71 12	105.83	211.66	3.2632	.9561	.0308	.0484
20	62.614	32.574	72 07	16 07	70 21	100.95	201.90	3.1000	.9517	.0307	.0482
31	62.894	34.660	63 26	24 55	61 47	69.31	138.62	2.0000	.8944	.0288	.0453
62	63.414	43.841	45 00	43 42	43 42	43.84	87.68	1.0000	.7071	.0228	.0358

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 63 TEETH

21	63.632	32.304	71 34	16 42	69 50	99.62	199.24	3.0000	.9487	.0301	.0473

PROPORTIONS OF MITER AND BEVEL GEARS BY G. W. AND S. LILLIAN KLAGES

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PROPORTIONS OF GEARS TO MATE WITH GEAR OF 64 TEETH

No. Teeth in Mating Gear	Outside Diameter	Apex Distance	Center Angle and Angle of Edge	Face Angle	Cutting Angle	Geometrical Pitch Circle Radius at Large End of Tooth	Geometrical Number of Teeth for Selecting Cutter	Ratio of Gear to its Mate	Decrements for Each 1-inch Length of Gear Face of: Geometrical Pitch Circle Radius	Pitch Circle Radius	Addendum	Tooth Thickness
	Ins.	Ins.				Ins.			Ins.	Ins.	Ins.	Ins.
12	64.368	32.557	79°23′	8°51′	77°37′	173.69	347.38	5.3333	.9829	.0307	.0482
13	64.398	32.654	78 32	9 44	76 46	160.74	321.48	4.9231	.9800	.0306	.0481
14	64.427	32.756	77 40	10 35	75 55	149.81	299.62	4.5714	.9769	.0305	.0479
15	64.456	32.866	76 49	11 26	75 04	140.31	280.62	4.2667	.9736	.0304	.0478
16	64.485	32.984	75 58	12 18	74 14	131.97	263.94	4.0000	.9701	.0303	.0476
17	64.514	33.111	75 07	13 09	73 23	124.59	249.18	3.7647	.9664	.0302	.0474
18	64.542	33.243	74 17	14 00	72 34	118.13	236.26	3.5556	.9626	.0301	.0472
19	64.569	33.380	73 28	14 49	71 45	112.45	224.90	3.3684	.9586	.0300	.0471
20	64.596	33.526	72 39	15 38	70 56	107.31	214.62	3.2000	.9545	.0298	.0468
32	64.894	35.778	63 26	24 58	61 50	71.55	143.10	2.0000	.8944	.0279	.0439
40	65.060	37.734	58 00	30 29	56 29	60.39	120.78	1.6000	.8480	.0265	.0416
64	65.414	45.255	45 00	43 44	43 44	45.25	90.50	1.0000	.7071	.0221	.0347

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 65 TEETH

13	65.392	33.144	78°41′	9°35′	76°57′	165.62	331.24	5.0000	.9806	.0302	.0474
26	65.743	35.003	68 12	20 10	66 34	87.51	175.02	2.5000	.9285	.0286	.0449

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 66 TEETH

12	66.358	33.541	79 42	8 36	78 00	184.56	369.12	5.5000	.9839	.0298	.0468
13	66.387	33.635	78 51	9 27	77 09	170.65	341.30	5.0769	.9811	.0297	.0467
14	66.415	33.735	78 01	10 17	76 19	158.94	317.88	4.7143	.9782	.0296	.0466
15	66.443	33.841	77 12	11 06	75 30	148.95	297.90	4.4000	.9751	.0295	.0464
16	66.471	33.957	76 22	11 57	74 41	140.00	280.00	4.1250	.9718	.0294	.0463
17	66.499	34.078	75 33	12 46	73 52	132.25	264.50	3.8824	.9684	.0293	.0461
18	66.526	34.204	74 45	13 35	73 05	125.46	250.92	3.6667	.9648	.0292	.0459
19	66.554	34.341	73 56	14 24	72 16	119.24	238.48	3.4737	.9609	.0291	.0457
20	66.580	34.483	73 08	15 12	71 28	113.73	227.46	3.3000	.9570	.0290	.0455
22	66.632	34.785	71 34	16 47	69 55	104.36	208.72	3.0000	.9487	.0287	.0452
33	66.894	36.896	63 26	25 01	61 53	73.79	147.58	2.0000	.8944	.0271	.0426
36	66.958	37.592	61 23	27 06	59 52	68.90	137.80	1.8333	.8778	.0266	.0418
44	67.109	39.658	56 19	32 14	54 52	59.50	119.00	1.5000	.8321	.0252	.0396

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 68 TEETH

12	68.347	34.524	80°00′	8°20′	78°20′	195.80	391.60	5.6667	.9848	.0290	.0455
13	68.375	34.615	79 11	9 10	77 32	181.17	362.34	5.2308	.9822	.0289	.0454
14	68.403	34.713	78 22	9 59	76 43	168.61	337.22	4.8571	.9795	.0288	.0452
15	68.431	34.816	77 34	10 47	75 55	157.92	315.84	4.5333	.9765	.0287	.0451
16	68.458	34.927	76 46	11 36	75 08	148.52	297.04	4.2500	.9734	.0286	.0450
17	68.485	35.046	75 58	12 24	74 20	140.21	280.42	4.0000	.9701	.0285	.0448
18	68.512	35.172	75 10	13 12	73 32	132.81	265.62	3.7778	.9667	.0284	.0447
19	68.538	35.304	74 23	14 00	72 46	126.30	252.60	3.5789	.9631	.0283	.0445
20	68.564	35.439	73 37	14 46	72 00	120.54	241.08	3.4000	.9594	.0282	.0443
34	68.894	38.014	63 26	25 04	61 56	76.02	152.04	2.0000	.8944	.0263	.0413

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 69 TEETH

23	69.632	36.366	71°34′	16°51′	69°59′	109.11	218.22	3.0000	.9487	.0275	.0432

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 70 TEETH

12	70.338	35.511	80°16′	8°07′	78°39′	207.03	414.06	5.8333	.9856	.0282	.0442
13	70.365	35.598	79 29	8 54	77 52	191.76	383.52	5.3846	.9832	.0281	.0441
14	70.392	35.694	78 41	9 43	77 05	178.36	356.72	5.0000	.9806	.0280	.0440
15	70.419	35.795	77 54	10 30	76 18	166.97	333.94	4.6667	.9778	.0279	.0439
16	70.446	35.904	77 07	11 17	75 31	156.97	313.94	4.3750	.9748	.0278	.0437
17	70.472	36.017	76 21	12 04	74 46	148.31	296.62	4.1176	.9718	.0278	.0436
18	70.498	36.138	75 35	12 50	74 00	140.58	281.16	3.8889	.9685	.0277	.0435
19	70.524	36.266	74 49	13 36	73 14	133.63	267.26	3.6842	.9651	.0276	.0433
20	70.550	36.401	74 03	14 23	72 29	127.37	254.74	3.5000	.9615	.0275	.0431
21	70.575	36.541	73 18	15 08	71 44	121.80	243.60	3.3333	.9578	.0274	.0430
28	70.743	37.696	68 12	20 17	66 41	94.25	188.50	2.5000	.9285	.0265	.0417
35	70.894	39.132	63 26	25 06	61 58	78.26	156.52	2.0000	.8944	.0255	.0401

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 72 TEETH

12	72.329	36.497	80°32′	7°54′	78°58′	218.88	437.76	6.0000	.9864	.0274	.0430
13	72.355	36.582	79 46	8 40	78 12	202.63	405.26	5.5385	.9841	.0273	.0429
14	72.382	36.674	79 00	9 26	77 26	188.67	377.34	5.1429	.9816	.0273	.0428
15	72.408	36.773	78 14	10 13	76 41	176.53	353.06	4.8000	.9790	.0272	.0427
16	72.434	36.879	77 28	10 59	75 55	165.89	331.78	4.5000	.9762	.0271	.0426
17	72.460	36.990	76 43	11 44	75 10	156.68	313.36	4.2353	.9732	.0270	.0425
18	72.485	37.107	75 58	12 29	74 25	148.46	296.92	4.0000	.9701	.0269	.0423
19	72.510	37.232	75 13	13 15	73 41	141.09	282.18	3.7895	.9669	.0269	.0422
20	72.535	37.362	74 29	13 59	72 57	134.57	269.14	3.6000	.9635	.0268	.0420
24	72.632	37.947	71 34	16 55	70 03	113.85	227.70	3.0000	.9487	.0263	.0414
32	72.812	39.397	66 02	22 31	64 35	88.62	177.24	2.2500	.9138	.0254	.0399
36	72.894	40.250	63 26	25 09	62 01	80.49	160.98	2.0000	.8944	.0248	.0390
48	73.109	43.263	56 19	32 22	55 00	64.91	129.82	1.5000	.8321	.0231	.0363
60	73.280	46.858	50 12	38 35	48 59	56.24	112.48	1.2000	.7683	.0213	.0335

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 74 TEETH

12	74.320	37.484	80°47′	7°41′	79°15′	231.00	462.00	6.1667	.9871	.0267	.0419
13	74.346	37.567	80 02	8 26	78 30	213.79	427.58	5.6923	.9849	.0266	.0418
14	74.372	37.657	79 17	9 12	77 46	198.98	397.96	5.2857	.9826	.0266	.0417
15	74.398	37.754	78 32	9 57	77 01	186.12	372.24	4.9333	.9800	.0265	.0416
16	74.423	37.855	77 48	10 41	76 17	175.09	350.18	4.6250	.9774	.0264	.0415
17	74.448	37.963	77 04	11 25	75 33	165.31	330.62	4.3529	.9746	.0263	.0414
18	74.473	38.078	76 20	12 10	74 50	156.60	313.20	4.1111	.9717	.0263	.0413
19	74.497	38.200	75 36	12 54	74 06	148.78	297.56	3.8947	.9686	.0262	.0411
20	74.522	38.326	74 53	13 37	73 23	141.88	283.76	3.7000	.9654	.0261	.0410
37	74.894	41.368	63 26	25 11	62 03	82.73	165.46	2.0000	.8944	.0242	.0380

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 75 TEETH

15	75.392	38.244	78°41′	9°49′	77°11′	191.10	382.20	5.0000	.9806	.0261	.0411
25	75.632	39.528	71 34	16 59	70 07	118.60	237.20	3.0000	.9487	.0253	.0397
30	75.743	40.389	68 12	20 23	66 47	100.98	201.96	2.5000	.9285	.0248	.0389

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 76 TEETH

12	76.312	38.470	81°02′	7°29′	79°33′	243.81	487.62	6.3333	.9878	.0260	.0408
13	76.337	38.551	80 18	8 13	78 49	225.53	451.06	5.8462	.9857	.0259	.0407
14	76.362	38.639	79 34	8 57	78 05	209.84	419.68	5.4286	.9835	.0259	.0407
15	76.387	38.733	78 50	9 41	77 21	196.22	392.44	5.0667	.9811	.0258	.0406
16	76.412	38.832	78 07	10 24	76 38	184.54	369.08	4.7500	.9786	.0258	.0405
17	76.437	38.940	77 23	11 09	75 55	173.97	347.94	4.4706	.9759	.0257	.0403
18	76.461	39.050	76 41	11 51	75 13	164.98	329.96	4.2222	.9731	.0256	.0402
19	76.485	39.169	75 58	12 34	74 30	156.71	313.42	4.0000	.9701	.0255	.0401
20	76.509	39.295	75 15	13 18	73 48	149.25	298.50	3.8000	.9670	.0254	.0400
38	76.894	42.486	63 26	25 13	62 05	84.96	169.92	2.0000	.8944	.0235	.0370

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 78 TEETH

12	78.304	39.459	81°15′	7°18′	79°48′	256.38	512.76	6.5000	.9884	.0253	.0398
13	78.329	39.538	80 32	8 01	79 05	237.12	474.24	6.0000	.9864	.0253	.0397
14	78.354	39.624	79 49	8 44	78 22	220.59	441.18	5.5714	.9842	.0252	.0396
19	78.473	40.139	76 19	12 15	74 53	164.87	329.74	4.1053	.9716	.0249	.0391
26	78.632	41.110	71 34	17 02	70 10	123.34	246.68	3.0000	.9487	.0243	.0382

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 80 TEETH

12	80.297	40.448	81°28′	7°07′	80°03′	269.58	539.16	6.6667	.9889	.0247	.0388
13	80.321	40.525	80 46	7 49	79 21	249.30	498.60	6.1538	.9870	.0247	.0388
14	80.345	40.609	80 04	8 31	78 39	231.88	463.76	5.7143	.9850	.0246	.0387
15	80.368	40.697	79 23	9 13	77 59	217.11	434.22	5.3333	.9829	.0246	.0386
16	80.392	40.793	78 41	9 55	77 17	203.84	407.68	5.0000	.9806	.0245	.0385
17	80.416	40.894	78 00	10 36	76 36	192.39	384.78	4.7059	.9781	.0245	.0384
18	80.439	41.000	77 19	11 17	75 55	182.18	364.36	4.4444	.9756	.0244	.0383
19	80.462	41.114	76 38	11 58	75 14	173.03	346.06	4.2105	.9729	.0243	.0382
20	80.485	41.230	75 58	12 39	74 35	164.96	329.82	4.0000	.9701	.0242	.0381
32	80.743	43.081	68 12	20 28	66 52	107.71	215.42	2.5000	.9285	.0232	.0365
40	80.894	44.722	63 26	25 17	62 09	89.44	178.88	2.0000	.8944	.0224	.0351
60	81.200	49.998	53 08	35 43	51 59	66.67	133.34	1.3333	.8000	.0200	.0314

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 81 TEETH

27	81.632	42.691	71°34′	17°06′	70°14′	128.08	256.16	3.0000	.9487	.0234	.0368

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 82 TEETH

12	82.290	41.437	81°40′	6°57′	80°17′	282.90	565.80	6.8333	.9894	.0241	.0379
13	82.313	41.513	80 59	7 38	79 36	261.61	523.22	6.3077	.9876	.0241	.0378
14	82.336	41.593	80 19	8 18	78 56	243.76	487.52	5.8571	.9858	.0240	.0378
16	82.383	41.772	78 58	9 40	77 36	214.23	428.46	5.1250	.9815	.0239	.0376
41	82.894	45.840	63 26	25 19	62 11	91.67	183.34	2.0000	.8944	.0218	.0343

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 84 TEETH

12	84.283	42.427	81°52′	6°47′	80°31′	296.86	593.72	7.0000	.9899	.0236	.0370
13	84.306	42.500	81 12	7 27	79 51	274.55	549.10	6.4615	.9882	.0235	.0370
14	84.329	42.580	80 32	8 07	79 11	255.36	510.72	6.0000	.9864	.0235	.0369
19	84.441	43.062	77 15	11 25	75 55	190.30	380.60	4.4211	.9753	.0232	.0365
20	84.463	43.175	76 36	12 05	75 17	181.23	362.46	4.2000	.9728	.0232	.0364
21	84.485	43.292	75 58	12 43	74 39	173.21	346.42	4.0000	.9701	.0231	.0363
28	84.632	44.272	71 34	17 08	70 16	132.83	265.66	3.0000	.9487	.0226	.0355
42	84.894	46.958	63 26	25 21	62 13	93.91	187.82	2.0000	.8944	.0213	.0334
48	84.992	48.376	60 15	28 34	59 04	84.64	169.28	1.7500	.8682	.0207	.0325

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 85 TEETH

15	85.347	43.155	80°00′	8°40′	78°40′	244.75	489.50	5.6667	.9848	.0232	.0364
17	85.392	43.343	78 41	10 00	77 22	216.58	433.16	5.0000	.9806	.0231	.0362

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 87 TEETH

No. Teeth in Mating Gear	Outside Diameter	Apex Distance	Center Angle and Angle of Edge	Face Angle	Cutting Angle	Geometrical Pitch Circle Radius at Large End of Tooth	Geometrical Number of Teeth for Selecting Cutter	Ratio of Gear to its Mate. Geometrical Pitch Circle Radius	Decrements for Each 1-inch Length of Gear Face of: Pitch Circle Radius	Addendum	Tooth Thickness
	Ins.	Ins.				Ins.			Ins.	Ins.	Ins.
29	87.632	45.853	71°34′	17°11′	70°19′	137.57	275.14	3.0000	.9487	.0218	.0343

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 88 TEETH

16	88.358	44.721	79°42′	9°01′	78°25′	246.08	492.16	5.5000	.9839	.0224	.0351
19	88.422	45.014	77 49	10 55	76 33	208.49	416.98	4.6316	.9775	.0222	.0349
20	88.443	45.121	77 12	11 32	75 56	198.60	397.20	4.4000	.9751	.0222	.0348
22	88.485	45.353	75 58	12 46	74 42	181.45	362.90	4.0000	.9701	.0220	.0346
44	88.894	49.194	63 26	25 24	62 16	98.38	196.76	2.0000	.8944	.0203	.0319

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 90 TEETH

15	90.329	45.621	80°32′	8°13′	79°17′	273.60	547.20	6.0000	.9864	.0219	.0344
18	90.392	45.892	78 41	10 04	77 26	229.32	458.64	5.0000	.9806	.0218	.0342
30	90.632	47.434	71 34	17 14	70 22	142.31	284.62	3.0000	.9487	.0211	.0331
36	90.743	48.466	68 12	20 37	67 01	121.17	242.34	2.5000	.9285	.0206	.0324
45	90.894	50.312	63 26	25 26	62 18	100.62	201.24	2.0000	.8944	.0199	.0312
60	91.109	54.079	56 19	32 37	55 15	81.14	162.28	1.5000	.8321	.0185	.0290

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 91 TEETH

13	91.283	45.962	81°52′	6°53′	80°37′	321.60	643.20	7.0000	.9899	.0218	.0342

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 92 TEETH

20	92.425	47.075	77°44′	11°03′	76°31′	216.51	433.02	4.6000	.9772	.0212	.0334

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 95 TEETH

19	95.392	48.441	78°41′	10°08′	77°30′	242.06	484.12	5.0000	.9806	.0206	.0324

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 96 TEETH

16	96.329	46.663	80 32	8 17	79 21	291.84	583.68	6.0000	.9864	.0205	.0323
24	96.485	49.476	75 58	12 53	74 49	197.95	395.90	4.0000	.9701	.0202	.0317
32	96.632	50.596	71 34	17 18	70 26	151.80	303.60	3.0000	.9487	.0198	.0310
48	96.894	53.666	63 26	25 30	62 22	107.32	214.64	2.0000	.8944	.0186	.0293

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 98 TEETH

14	98.283	49.498	81°52′	6°59′	80°43′	346.34	692.68	7.0000	.9899	.0202	.0317

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 99 TEETH

33	99.632	52.177	71°34′	17°20′	70°28′	156.55	313.10	3.0000	.9487	.0192	.0301

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 100 TEETH

20	100.392	50.991	78°41′	10°12′	77°34′	254.80	509.60	5.0000	.9806	.0196	.0308
25	100.485	51.538	75 58	12 55	74 51	206.20	412.40	4.0000	.9701	.0194	.0305
40	100.743	53.851	68 12	20 44	67 08	134.64	269.28	2.5000	.9285	.0186	.0292

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 102 TEETH

17	102.329	51.704	80°32′	8°22′	79°26′	310.08	620.16	6.0000	.9864	.0193	.0304
34	102.632	53.759	71 34	17 22	70 30	161.29	322.58	3.0000	.9487	.0186	.0292

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 104 TEETH

26	104.485	53.600	75°58′	12°58′	74°54′	214.45	428.90	4.0000	.9701	.0187	.0293

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 105 TEETH

35	105.632	55.340	71°34′	17°24′	70°32′	166.03	332.06	3.0000	.9487	.0181	.0284

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 108 TEETH

18	108.329	54.746	80°32′	8°25′	79°29′	328.33	656.66	6.0000	.9864	.0183	.0287
36	108.632	56.921	71 34	17 26	70 34	170.78	341.56	3.0000	.9487	.0176	.0276
48	108.812	59.095	66 02	23 00	65 04	132.94	265.88	2.2500	.9138	.0169	.0266

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 110 TEETH

22	110.392	56.090	78°41′	10°18′	77°40′	280.28	560.56	5.0000	.9806	.0178	.0280

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 111 TEETH

No. Teeth in Mating Gear	Outside Diameter	Apex Distance	Center Angle and Angle of Edge	Face Angle	Cutting Angle	Geometrical Pitch Circle Radius at Large End of Tooth	Geometrical Number of Teeth for Selecting Cutter	Ratio of Gear to its Mate. Geometrical Pitch Circle Radius	Decrements for Each 1-inch Length of Gear Face of: Pitch Circle Radius	Addendum	Tooth Thickness
	Ins.	Ins.				Ins.			Ins.	Ins.	Ins.
37	111.632	58.502	71°34′	17°28′	70°36′	175.52	351.04	3.0000	.9487	.0171	.0269

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 112 TEETH

28	112.485	57.723	75°58′	13°02′	74°58′	230.94	461.88	4.0000	.9701	.0173	.0272
32	112.550	58.242	74 03	14 58	73 04	203.79	407.58	3.5000	.9615	.0172	.0270

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 114 TEETH

38	114.632	60.083	71°34′	17°29′	70°37′	180.27	360.54	3.0000	.9487	.0166	.0261

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 116 TEETH

29	116.485	59.785	75°58′	13°04′	75°00′	239.19	478.38	4.0000	.9702	.0167	.0263

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 120 TEETH

24	120.392	61.190	78°41′	10°23′	77°45′	305.76	611.52	5.0000	.9806	.0163	.0257
30	120.485	61.846	75 58	13 06	75 02	247.44	494.88	4.0000	.9701	.0162	.0254
40	120.632	63.245	71 34	17 32	70 40	189.75	379.50	3.0000	.9487	.0158	.0248
48	120.743	64.621	68 12	20 55	67 19	161.56	323.12	2.5000	.9285	.0155	.0243
60	120.894	67.083	63 26	25 43	62 35	134.16	268.32	2.0000	.8944	.0149	.0234

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 125 TEETH

25	125.392	63.739	78°41′	10°25′	77°47′	318.50	637.00	5.0000	.9806	.0157	.0246

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 128 TEETH

32	128.485	65.969	75°58′	13°10′	75°06′	263.93	527.86	4.0000	.9702	.0152	.0238

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 130 TEETH

26	130.392	66.288	78°41′	10°27′	77°49′	331.24	662.48	5.0000	.9806	.0151	.0237

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 132 TEETH

33	132.485	68.031	75°58′	13°11′	75°07′	272.18	544.36	4.0000	.9702	.0147	.0231

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 136 TEETH

34	136.485	70.092	75°58′	13°13′	75°09′	280.42	560.84	4.0000	.9702	.0143	.0224

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 140 TEETH

28	140.392	71.387	78°41′	10°31′	77°53′	356.72	713.44	5.0000	.9806	.0140	.0220
35	140.485	72.154	75 58	13 14	75 10	288.67	577.34	4.0000	.9702	.0139	.0218

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 144 TEETH

36	144.485	74.215	75°58′	13°16′	75°12′	296.92	593.84	4.0000	.9702	.0135	.0212

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 145 TEETH

29	145.392	73.937	78°41′	10°33′	77°55′	369.46	738.92	5.0000	.9806	.0135	.0212

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 148 TEETH

37	148.485	76.277	75°58′	13°17′	75°13′	305.17	610.34	4.0000	.9702	.0131	.0206

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 150 TEETH

30	150.392	76.486	78°41′	10°34′	77°56′	382.20	764.40	5.0000	.9806	.0131	.0205

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 152 TEETH

38	152.485	78.339	75°58′	13°18′	75°14′	313.41	626.82	4.0000	.9702	.0128	.0201

PROPORTIONS OF GEARS TO MATE WITH GEAR OF 160 TEETH

32	160.392	81.586	78°41′	10°37′	77°59′	407.68	815.36	5.0000	.9806	.0123	.0193

To avoid possible confusion in the use of this series of tables the column headings should have more properly read "Proportions of a ..... tooth gear to mate with the gears given in the left-hand column."

The Periodograph Recording System

By W. L. Miller*

An excellent system for keeping track of the time taken by the workmen on the various jobs or operations, made possible by the invention of a suitable recorder.

*Gisholt Machine Co., Madison, Wis.

About six years ago, when installing a new cost system for our shops, we found that there was no suitable recorder for keeping track of the time taken by workmen on any certain job or operation. All of the clocks or systems then in use were impracticable or complicated. An article by H. B. McCabe, on "A Decimal Time System for Factories," appearing at that time in the AMERICAN MACHINIST, Vol. 28, part II, page 511, opened up a correspondence which resulted in the development of the system herein described. The recorder illustrated and described can, therefore, very properly be classed as an invention, as it was the result of necessity. It will be placed in the market by the Gisholt Machine Co.

A periodograph *W* is shown in Fig. 1, connected with a transmitter, which can be operated by batteries or by the lighting current. Lamp *A* is used for resistance when operating on 110- or 120-volt shop current. The switch, etc., is mounted on the back-board, and the case *B* covering the transmitter is so hinged that when open the entire transmitter mechanism may be examined, as shown in Figs. 2 and 3.

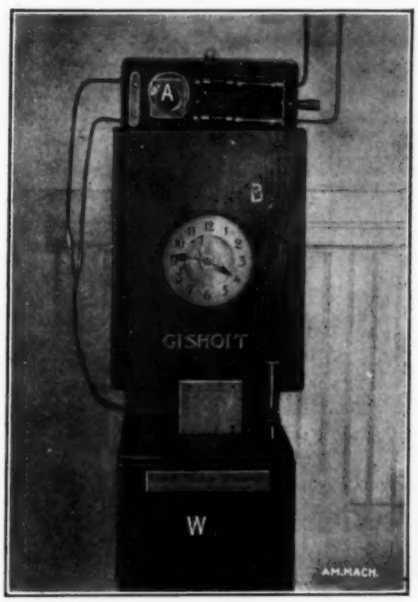


FIG. 1. THE PERIODOGRAPH

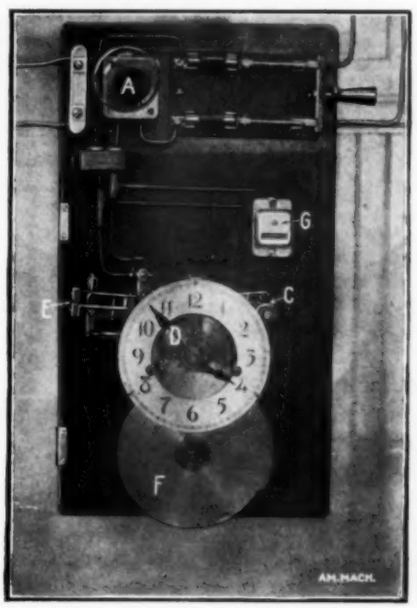


FIG. 2. WITH COVER REMOVED

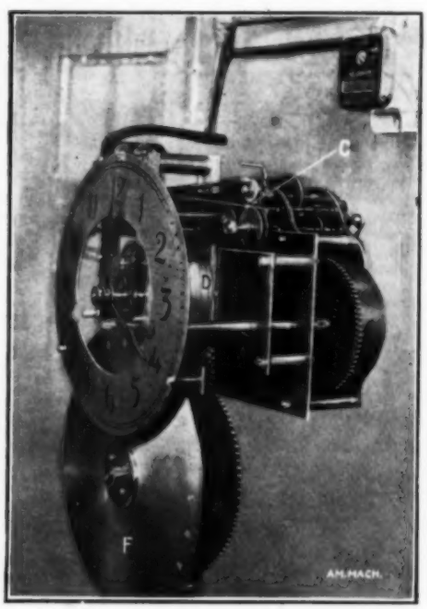


FIG. 3. THE MECHANISM

The electrical contact is made at point *C* when the notched disk *D* on the minute hand allows the switch to close; this disk *D* has four or ten notches, depending on whether the shop is operating on quarter- or tenth-hour periods. Contact is made at the point *C* before the carbons *E* come in contact, but broken at the carbons *E* before the switch is parted at *C*, thus eliminating all sparking and wear, which is a fault of all electrically controlled mechanisms using platinum points for making and breaking the contacts. The 24-hour dial *F* is made to suit the working hours of the shop and keeps the switch from closing during the nonworking hours of the day and night. The switch mechanism is attached directly to a specially designed eight-day jeweled clock movement. The flush switch *G* is used in case it is desired to operate all the periodograph recorders on the circuit simultaneously when the whistle blows, or to advance them one or more periods for any reason.

A front view, Fig. 4, partly in elevation, shows the periodograph removed from its case. The recorder can be set down flush with the table or desk, if desired. The entire design is very heavy and substantial, being designed more like a machine than a clock mechanism. Only one lever is necessary, as the card is automatically located each time it is inserted, by a punched hole opposite the previously recorded period. In Fig. 4 the cover plate is removed and the upper ribbon spool *N* is shown swung up in position for rewinding the ribbon from the lower spool *T*, or for changing the dates, which is accomplished by pressing on the pawl *P*. The four engraved period dials *O* are controlled by ratchets *R*; pawls *S* prevent the dials from carrying over more than one space when the magnet *V* is energized. The ribbon has an automatic feed *Q* and the month dial is automatically carried over to the next month when the date dial for the 31st is changed.

THE CARDS USED

Referring now to the job ticket, Fig. 6 is a form used for the erecting department. Fig. 7 is used for the machine departments, and shows the method of figuring a premium job, the workman being allowed half the time saved. By referring to the tickets, it will be noted that the man started at 0000 (7 a.m.) on Oct. 1, and worked 14 quarter-hours on order No. 10,642, then changed to order No. 276, working from the 14th quarter-hour on Oct. 1 until the 53d quarter-hour on the second, then changing back to order No. 10,642, etc. The tickets can be printed on both sides, to provide space for additional starts and stops, or the back can be used as a record of inspections or for the workman to write down what his next job is to be.

A different application is seen in Fig. 8. Here a single card answers both as a payroll card and job ticket; each workman starts with a new card each day, ringing out and in at noon, as well as each time during the day that he changes jobs. This form is especially suited to small shops or departments where pay-

roll clocks are not at present installed. The periodograph is so called because it records periods of quarter- and tenth-hours during the working hours of the day.

The Method Used

The method used in connection with this recorder was designed to meet all the objections of the older systems and methods. The operation is as follows:

On the first morning of each month, or pay period, each man is supplied with a job ticket, giving the month and date, and stamped "0000." The time system can be worked either quarter-hour basis or the tenth-hour scheme, thus eliminating all fractions and making it possible to add the quarter- or tenth-hours, and the cost of labor at one operation on a double-adding machine.

The first time the card is registered the figures appear in the lowest space, indicating the period that a man started to work on the job; when the job is stopped or completed, regardless of whether it is in a few minutes or a number of days, the card is again placed in the recorder to write the cards and operate the recorder to save the time of the workmen.

Upon leaving the plant at noon or night, each workman deposits his card, and the time and number of the job are registered just above the time of starting. When the time is registered on the card it is a very simple matter to subtract the lower figure from the upper and get the net periods of quarter- or tenth-hours devoted to the work. Spaces are provided for several starts and stops, and the net periods being carried out on the right of the cards, makes it very easy to sum up the total periods put in on the job. The stamp automatically locates the card so that the recorder can be placed in any department and operated by the workmen with no chance of making a mistake; in large departments a clock boy is located for the job upon which he is working, in a rack near the shop entrance, the workman simply placing his job ticket in the pocket from which he removes his payroll card. Upon entering the shop at morning and noon, each man takes his ticket with him to the shop, so that he can change it at any time during the day when he changes jobs. In case a workman is late or absent, the timekeeper removes his ticket from the rack, as soon as the whistle blows, and stamps the card with the stopping time of the previous noon or night, and places an "out" card in the rack.

This card, Fig. 9, is used also to indicate "vacant" numbers on the payroll, and when used for this purpose the "vacant" end of the card is placed in the card rack; by this method the timekeeper can tell at a glance if any workman has neglected to place his job ticket in the rack at noon or night. Upon entering the shop when late or after being out for a half day or more, the workman exchanges this "out" card for his job ticket, which is then properly stamped with the date and period of starting. The card used on this recorder gives ample space at the top and left-hand side for any list of departments, operations or other information which it is desired printed thereon, and it works equally well on premium, piece or day work. Various-colored cards can be used for indicating the different classes of work or different

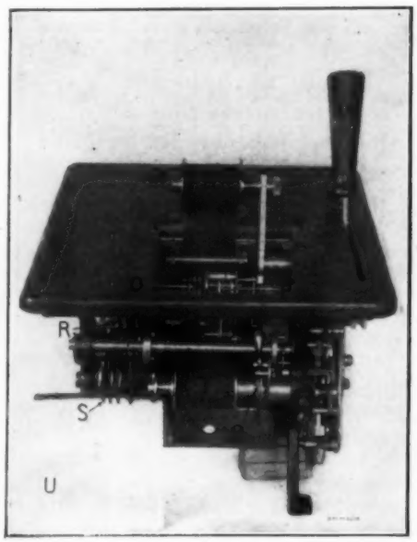


Fig. 4 The Periodograph Removed from Its Case

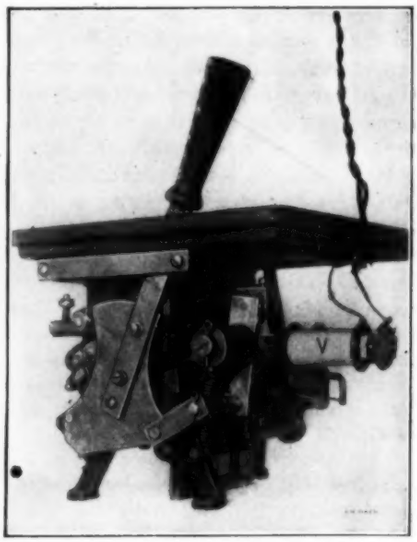


Fig. 5

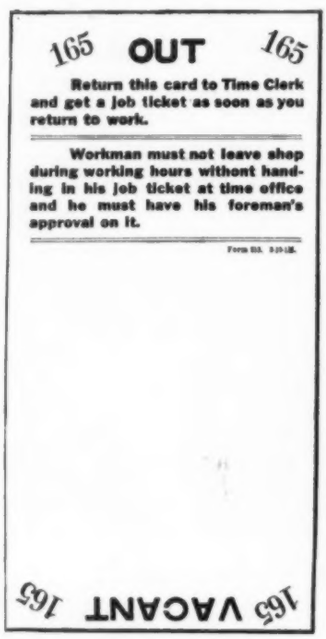

165 OUT 165
Return this card to Time Clerk and get a job ticket as soon as you return to work.
Workman must not leave shop during working hours without handing in his job ticket at time office and he must have his foreman's approval on it.
165 VACANT 165

Fig. 6

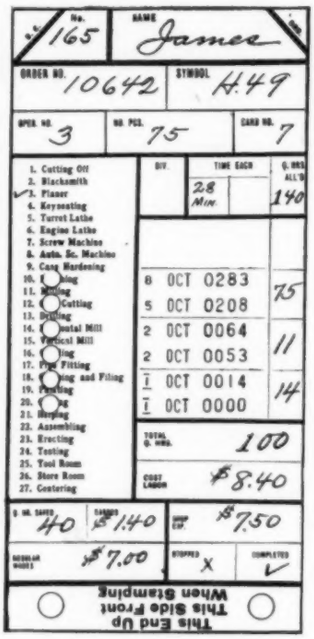


Fig. 7

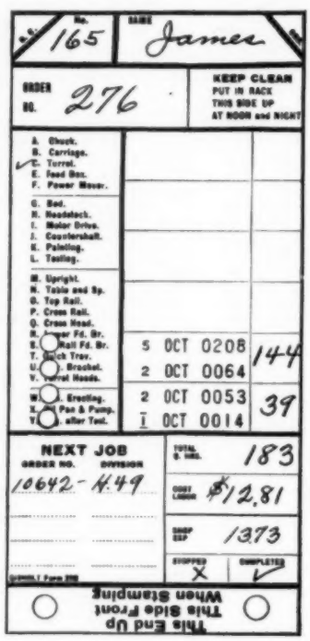


Fig. 8

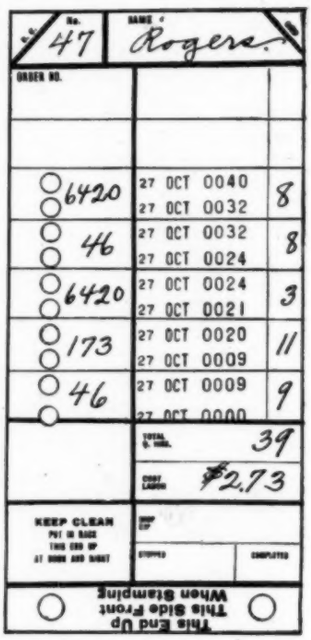


Fig. 9

departments. Punched holes at the bottom of the card prevent the possibility of the card being inserted upside down.

Controlling Job and Payroll Records

Another valuable feature of the recorder is that when a workman presents a job ticket to be stopped, he must always know the next order number upon which he is going to work, as the clerk refuses to stop an old card until the workman is ready to start on a new job. The lever *M* operates the hammer in either direction, and is so arranged that it automatically locks the period dials between the impressions for stopping a man's old card and starting his new one. This prevents jumping a period in case the automatic dial-changing mechanism should be energized between the forward and backward strokes of the operating lever. This is a valuable feature, as it gives an absolute guaranty that a man's job tickets will check up with his payroll record.

At the end of each month cards are first thrown according to men's numbers, and a chart is used for figuring up the cost of labor and shop expense; they are then re-sorted according to order number and entered on suitable card-index or loose-leaf sheets, and the upper right-hand corner is clipped to show what cards have been "entered order number." If it is desired to enter the detail cost of the various pieces either before or after they have been "entered order number," the upper left-hand corner is clipped, to show that they have been "entered detail cost." It is thus unnecessary to stamp the cards with a rubber stamp, and cards can be sorted and re-sorted, and at any time the cost clerk knows at a glance just what entries have been made from each card.

Machinery Market in Latin-America

By Archibald J. Wolfe

Emphasis is laid upon the extent of the field. The salesmen should be carefully selected, should have tact, and be patient in developing the market.

Latin-American countries naturally divide in three groups, depending upon the language spoken.

Latin America looms today as one of the world's most important markets for American products, and not least among these is American-built machinery. American manufacturers of machinery show a growing appreciation of this fact. There is hardly a steamer bound for Latin-American ports from New York or New Orleans that does not carry a substantial contingent of men in the various stages of training as successful salesmen in these regions.

Some of them are going back to routes well known to them, to maintain and increase an established trade; others go forth to fields new to them, but equipped with a good knowledge of Spanish and Portuguese, and with a capacity for learning and adapting themselves to new surroundings.

What Kind of Salesman Shall We Send?

Not long ago, a manufacturer propounded the question whether it is better to send into the Latin-American market a man with a thorough knowledge of his line, but without a knowledge of the countries and the languages spoken there, or to appoint an applicant with a good knowledge of the countries and languages concerned, but not sufficiently familiar with the line he was expected to carry.

The question is an important one from two points of view. It shows that the manufacturers grasp the essential idea that they must send *men* and not *catalogs;* and again it shows that they realize that enough time has been wasted, and that they must send men *now*. Thus a manufacturer reconciles himself to the fact that for the present he must send handicapped men—either handicapped in the matter of approach, or in a knowledge of the goods he wishes to sell. Compared with the highly trained and absolutely competent men that Germany and England—particularly Germany—send to South America, the handicap is a great one, but the condition pointed out is only temporary, and shows every sign of passing rapidly away.

With regard to marketing machinery in this territory, it may be said along general lines that next to a realization of the inadequacy of the catalog route in the establishment of a successful and important trade in machinery, and of the necessity of sending men, it will be necessary to adopt commonsense methods of marketing. It will be found that where persistence, organization and system have aided excellence of product in building up a substantial home trade, the same principles must be adopted to trade with Latin-America.

Here a point is reached where each different class of machinery will demand different modes of procedure in marketing. There will also be some difference, in accordance with the particular countries with which a business is to be established. The trade of Brazil will have to be tackled a little differently from that of Panama, Argentina or Peru.

The "Extractive" Industries

It may be said, however, that the majority of the tropical countries have industries that are termed "extractive." They are raisers of various classes of fruits, coffee, cocoa, rubber and cattle; they are producers of minerals, etc. Manufacturing industries are in their infancy, and in some of the countries non-existent. As a market for machinery, therefore, only those machines and implements auxiliary to the so called "extractive" industries are to be considered.

Competition to Contend with

Machinery in Latin-America is sold to two classes of buyers. To houses which sell machines to their customers, and to concerns which use machines in their own enterprises. Here some difference will be experienced in chances for selling American machines, in accordance with the control under which the particular enterprise is capitalized. British-owned nitrate fields in Chile will show a natural preference for installing British machinery. American mines in Peru, or railway enterprises capitalized by Americans in Brazil and elsewhere, will be more promising customers for American machines. There are vast enterprises variously controlled by British, German, French and some by American interests.

In addition to the "extractive" industries and allied enterprises requiring machinery (giving due consideration to the various classes of customers as indicated above) a survey of general marketing conditions for machinery will demand also the mention of manufacturing industries in Brazil, Argentina and Chile, in which machines of various classes, particularly machine tools are also demanded. In Brazil the textile industry is increasing in extent. In Argentina the manufacturing industries are quite diversified, and the numerous machine shops and repair shops—many of them owned by Italian engineers—require metal and woodworking tools, as they manufacture furniture, metal bedsteads and quite a few other things which not long ago were articles of import. The scarcity of labor also makes the use of labor-saving machinery a direct necessity. In Chile an important movement for fostering manufactures is on foot, and the government gives it every encouragement.

Groups of Latin-American Countries

In approaching this market, it will be noted that the 20 Latin-American republics are naturally divided into certain well defined and naturally connected groups, which it is well to take under

consideration as such. They ought to be considered in the following order: Mexico, Cuba, Haiti and San Domingo (the last two, of the West Indian group, being almost negligible from the viewpoint of the American machinery manufacturer; then the Central-American group: Costa Rica, Guatemala, Honduras, Salvador and Nicaragua. Panama and the Canal Zone, though not usually grouped politically with the Central-American republics, are best considered along with them; as a marketing possibility. In this group American influence is naturally dominant. The Northern republics of South America—Venezuela and Colombia—constitute a very backward market for American machinery.

On the east coast is the great and important market of Brazil, so vast that some sections are as difficult of access from one to the other as Alaska and Florida; then the River Plate countries: Argentina, the overshadowing component of this group, Uruguay, a very promising little market, and Paraguay, almost entirely negligible; then finally the west coast group: Chile, Peru and the landlocked republic of Bolivia with its vast mineral wealth, and finally Ecuador.

In all of these countries the language of the people and of commerce is Spanish, excepting in Brazil, where Portuguese is the language of the land, and Haiti, where French is spoken. These people have their own way of doing business, their own preferences, which the older commercial competitors of the United States have carefully studied and humored. The way to write to these people, to speak to them and to approacn them is in their own language.

With regard to publicity, a trade press in Latin-America is practically nonexistent. Special papers for special trades are few and far between, and cannot compare in size, appearance, contents, standing or importance with American, British or German trade papers. There are few newspapers of high rank, like *La Prensa* in Argentina, *Jornal do Brasil* or *Jornal do Commercio* in Brazil, few magazines of wide circulation but a vast number of small local sheets of very inferior appearance.

With the exception of Panama and Mexico there are no banks with distinctly American affiliations. Some banks are national, others are under British or German, a few under French and Italian control. In all these countries there are American consular officers, and while they are eager to promote American commerce, it must be understood that their functions are not at all intended to include selling for individual concerns.

The Need of Tact

An article dealing with the general marketing conditions in Latin-America should not leave unmentioned the utmost importance of approaching the Latin people in a manner agreeable to them. The essence of salesmanship is in finding the right mode of approach. A salesman at home will tackle the prospective customer with a due regard for his individuality. The Latin customer has an individuality very different from that of an American customer. You can burst into the office of an American and show him where he can save a few thousand dollars in connection with a contemplated enterprise. A Latin-American will consider it an impertinence. A salesman in this country may say:

> Mr. Brown, if you install this system in the mill, which I understand you are going to put up, I can show you where you can effect a saving of so and so many per cent. and increase your output so and so many per cent.

To a Latin-American you must say in a more leisurely manner:

> Señor Rodriguez, some day you may feel like putting up a mill. When that time comes you may feel inclined to use an uptodate American system, which has proved very efficient in the United States, and in many instances has saved much money to the enterprising owners who have adopted it.

Señor Rodriguez will be duly interested, but if you intimate to him that you are aware of his putting up a mill in the near future, he will crawl into his shell and will not only be very suspicious of the man who knows so much of his business, but deeply resent the intrusion.

Minute attention to orders, to shipping instructions, to packing, and particularly to consular invoices is an absolute necessity. This is not the place to do more than mention these matters in passing. They have been dwelt on so long that only infant-class exporters need to have these things dinned into their ears. A little negligence in any of these matters has caused deep annoyance, much expense and loss of trade.

In conclusion, it may be stated, by way of summing up, that the manufacturer of machinery who intends to invade this field systematically will first study his own product and determine to what classes of customers and in what countries of Latin-America his machines can be largely sold. Then he will study the best marketing methods appropriate to his class of machines and to the countries where they are to be sold.

He will then go ahead, make the most rational arrangements to meet the conditions determined, and systematically build up and cultivate his trade, persistently and with the fullest attention to details, so that the reproach that we turn to export markets as a side issue only, when we are not too busy at home, may be wiped away. The Latin-American trade will then be found an important, permanent and steadily increasing asset.

The Present Trend of Development in Electrical Machinery

By B. G. Lamme*

In looking over the field of development of electrical machinery for the past year, it appears that many of the advances are found in the direction of improvements in construction, and in operating characteristics. There has been a very decided tendency toward those designs and constructions which represent better manufacturing conditions. In the designs of the newer electrical machinery, there is evidence of a much greater refinement than heretofore; or, to express it in another way, the newer designs are the result of what might be called analytical engineering. In other words, there is much more refinement in calculation and use of materials than in the past.

This evidence of improvement along well known lines is indicated, for example, by the more extended use of commutating poles in commutating machinery; by improved methods of ventilation in both open and inclosed machines; by the use of better materials in the machines themselves, both in the quality of material and its treatment in the course of manufacture; by the use of insulations which are adapted for temperature conditions, as well as insulation purposes, etc.

The growth of the electrical industry in the past has been so rapid that necessarily there was more or less crudity in the apparatus itself, due to insufficient opportunity and experience to perfect the types or designs. As long as types and applications were changing so rapidly, there was naturally insufficient opportunity for applying refinements of design and construction which were bound to come in time. These refinements, which are of leading importance in the steady growth of business, have been taking place in the recent past, and they really represent as much advance in the electrical art as some of the apparently more radical developments which preceded them.—*Electric Journal.*

When dry, peat is generally lighter in color than when freshly dug and will usually float if placed in water, although this is not always true of the dark-colored, plastic kinds that are high in ash, and when thoroughly dry are as compact and nearly as hard as coal. Except for such types, raw or untreated peat is easily crumbled to powder when handled, and makes bulky and unsubstantial fuel that does not bear transportation well. The name "muck" is commonly applied to black, impure peats of the more completely decomposed types.

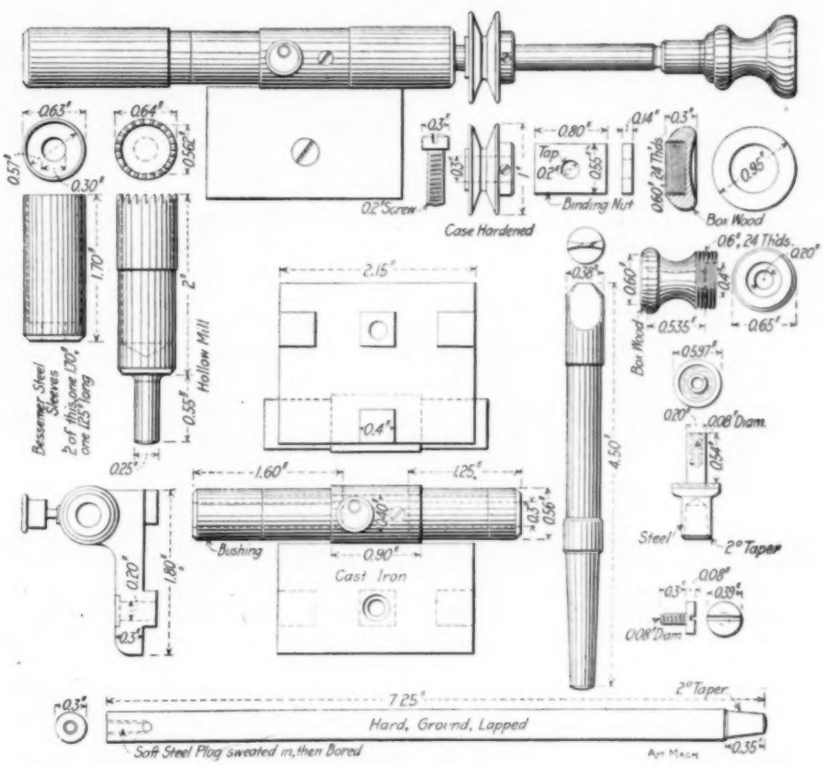
*Engineer, Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Making a Slide Rest Grinding Attachment

Many of the slide-rest grinding attachments used in the bench lathe have the spindle more or less exposed to the wheel dust, and require frequent cleaning while doing work. The outline and details inclosed are of an attachment built to meet my own requirements. As most of my work requiring grinding is less than an inch long, it was desirable to have the spindle protected so that when running, no dust could reach any part of it within the bushings.



SLIDE-REST GRINDING ATTACHMENT

Referring to the details, it will be seen that the bottom of the base is provided with four lugs, which were milled to fit the T-slot in the slide-rest, thus allowing the attachment to be placed parallel or at right angle to it. The method of boring the hole in the housing proved satisfactory, and is as follows: With the centers in the lathe and the base in position on the slide-rest, a line was scribed across the ends of the boss by operating the cross-feed screw. Then, removing the base it was center-punched and drilled half-way through from each end with a 0.25-in. twist drill. It was next replaced, and the drill with taper shank, shown in the details, was put through, by driving it in a taper chuck and feeding with the slide-rest screw. This was followed by a 0.397-in. reamer, also with taper shank, and driven in the same manner. After the lapping of the hole in the base and bushings, the latter were ground and lapped on the outside, then pressed in lightly.

Although the bushings are sometimes ground to a driving fit, I prefer to lap them, as this method does away with some lapping after the bushings are in place. In order to protect the spindle as much as possible without weakening the housing, the housing was cut out as shown, with the hollow mill. The mill was bored slightly back-taper and 0.002 in. larger at the front end than the diameter of the heads of the bushings. The outside of the mill only was ground, to give it a little clearance; then by chucking it in a 0.25-in. collet and holding the base in the hand with one bushing on the center in the tailstock, the bushings were ed into the mill to the proper depth by means of the handwheel.

The 0.30-in. hole in the bessemer-steel sleeves were reamed with the regular reamer, this leaving them just right for a friction fit on the spindle. The front sleeve is seldom removed, while the other may be provided with a small screw in case of wear, due to frequent adjustment. This attachment, unlike some, has two oil holes; to fill the chamber the screw is removed before injecting the oil into the cup. The screw hole acts as a vent for the displacement of air, allowing the oil to enter freely. The spindle was made of Jessop steel, leaving 0.01 in. to grind after hardening. A soft-steel plug was sweated into the spindle, this was bored out for the wheel mount after the spindle was lapped to size. The boxwood knob, shown in detail, is carried in stock, also the binding nut, and the pulley was made of bessemer steel, case hardened.

Elgin, Ill. GUS HAESSLER.

Press Tools for a Steel Lever

The acetylene gas generator used on the Ford automobile embodies a pair of pressed-steel levers for actuating a toggle clamping device which holds the upper and lower parts of the generator together.

As the method of producing these levers from flat metal is rather unusual a description of the pressed tools for accomplishing this will prove of general interest. The sequence of operations is shown in Fig. 1 and the approximate sizes are marked on the various views.

The piercing and blanking are done in a simple progressive die, the construction of which is shown in Fig. 2. The holes are pierced in the first position and the blanking is done in the second stage of the work, a finished blank being produced at each stroke of the press.

The next operation is the twisting of the blank so that the two ends stand at 90 degrees to each other. This is accomplished in a hand-operated fixture, the construction of which is shown in Fig. 3. It consists primarily of a cast-iron base upon which are mounted two steel blocks,

one of which, marked *A*, is provided with a reciprocating rod *B*. This rod is slotted at one end to receive the end of the lever containing the holes, and is operated by a

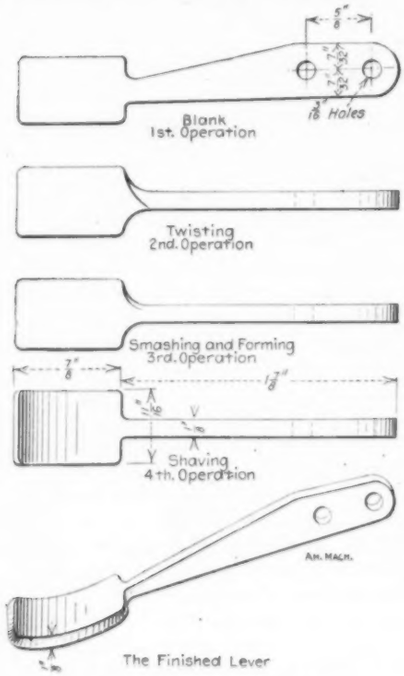


FIG. 1. THE PRESSED-STEEL LEVER

swinging pivoted lever *C* controlled by the left hand of the operator. A thin stripper-plate *D* depends into the slot in *B* and serves to strip the lever from the rod *B* when the operating lever *C* is manipulated. The second block *E* carries the rocking shaft *F*, which is also slotted to receive the large end of the lever. The rocking shaft is actuated by a handle *G* as shown in the cut.

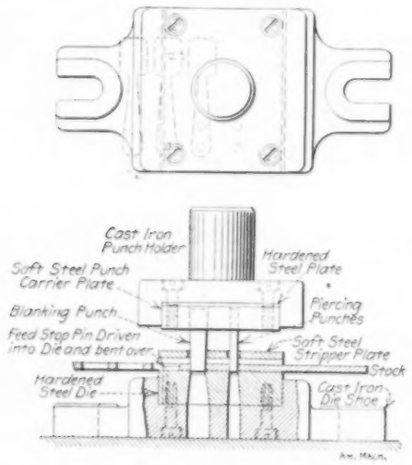


FIG. 2. THE PIERCING AND BLANKING DIE

When the fixture is in a loading position both slots register in a vertical plane and the lever blank is dropped into place. Handle *G* is rotated and then handle *C* is pushed back, releasing the work so that it may be removed readily. The work now has a sharp twist at its necked portion and the next operation is the smashing or flattening of the twist-in portion. This is done in the die shown in Fig. 4.

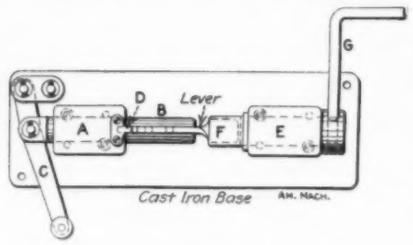


FIG. 3. THE TWISTING FIXTURE

Its construction requires no detailed explanation. The lever now presents a smooth top and bottom surface but has, of course, spread considerably at the neck due to the smashing operation. It is now placed in the shaving die and trimmed to size, at the same time being formed, by the action of the contoured punch used in the shaving die. A detailed view of this die is shown in Fig. 5. The lever is now ready for polishing and plating.

It puzzles most people to determine how the piece is made, and the suggested solutions offered by various people are more or less amusing. Some say it is a die casting, others that it is a drop forging and still others declare it to be milled from a solid blank.

Detroit, Mich. ARON LAWRENCE.

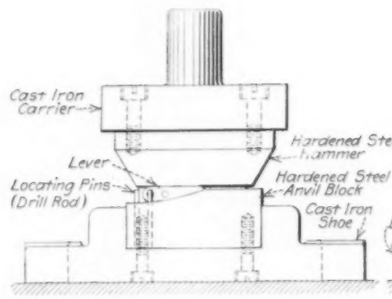


FIG. 4. THE SMASHING DIE

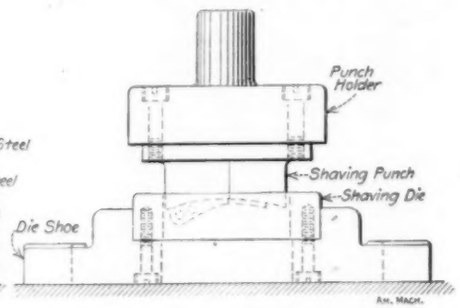


FIG. 5. THE SHAVING DIE

Repairing a Crankshaft in an Old Shop

It was the crankshaft of a small steam engine, the crankshaft, crank disk, governor pulley and eccentric all being cast in one piece, the only part to be added to the queer combination being the wristpin, which was screwed in with a left-hand thread. This had worked loose, and the thread, both in the disk and on the pin, was all torn up, especially in the disk. There was a somewhat deep counterbore in the disk for the shoulder of the wristpin, the circumference of which was well defined. The crankshaft was about 4½ ft. long, and 3$\frac{13}{16}$ in. where finished.

In the basement of the shop was a pile of old iron flanges, such as would be used on sawmill shafting for large wood pulleys. I went down and got one that drove tight on the outboard end of the shaft, and keyed it there. I got another with the bore a little less than the diameter of the counterbore in the crank disk, and with a hub two or three inches long, I put this into a chuck and bored out the hub to the full size of the counterbore, and took a cut on the outside of the hub; then drove a plug of wood into the hole for the wristpin, found and marked the center, and with a pair of dividers took the distance from the center of the shaft to the center of the wristpin marked on the wooden plug, and with the same radius struck from the center on the other end of the shaft an arc on the outer face of the flange. The shaft was now put on the centers of a 30-in. lathe that had just been installed, and a long lathe tool was put in the tool post, and against the face of the crank disk, which was turned until the center in the wooden plug was even with the top of the lathe tool. Then I set up the tail center pretty tight, and drew back the tool post, shifted the carriage to the other end of the shaft, ran the tool post in the same distance as before, and with the lathe tool against the face of the flange, drew a line, cutting the arc that I struck on the face of the flange earlier in the operation.

I now had two points equally distant from the centers of the shaft, and in a plane passing through them. I now took the shaft out of the lathe and drilled a center in the place that one of those points marked on the flange. Two holes were drilled through the crank disk corresponding to two holes already in the flange with the hub, the flange was bolted on the crank disk, so that the bore of the hub corresponded with the circumference of the counterbore in the crank disk, setting up the bolts good and tight.

The large faceplate was then put on the lathe, and the shaft back in it, but not as before. I put the center that I had drilled in the flange on to the live center of the lathe, and put the hub of the other flange in the center rest. A clasp was put on to hold the flange on the center, a small angle-plate was bolted to the face-

plate for a driver, and another to take care of the blacklash. The tailstock was shoved back out of the way, and a long inside-threading tool was put into the tool post.

With this I had to reach through the hub that was running in the center rest, and through the crank disk. It required only a few minutes to clean up the thread in good shape. In taking the two or three last cuts, I drew the tool a trifle toward me, to give a little taper, so as to make it easier to fit. Cutting, of course, was from left to right. As quickly as possible I got it out of the lathe, and took the flanges off.

The next thing was material to make the wristpin of. In this I was particularly fortunate, for I found a piece of machine steel about 8 in. long and 3 in. diameter. One end of it was forged down to a square to fit a very heavy wrench. This was quickly shaped. It was made with two collars, one of them forming the shoulder against the counterbore. The thread was cut a good deal by trial. By adjustment of the taper of the lathe, and also of the thread-cutting tool, I soon had things so that the threads would rub together all over, and a moderate force would put it within half an inch of home. With the crankshaft on the floor, with a steel pin driven into each of the holes drilled in the crank disk, and with a long, flat iron bar set up edgewise between the pins, and clamped to the disk, I had things where they would stay put.

The wristpin was put into place, with plenty of oil, and turned as far as possible with a 4-ft. wrench. I then lengthened the wrench with a piece of pipe to 6 or 7 ft. With the assistance of two others, and with a little hammering, the pin was driven hard home, and I did not feel the least fear that it would ever come loose again. I sawed off the waste piece and filed up the end of the pin, and the job, which required about four hours, was done.

T. HODGSON.

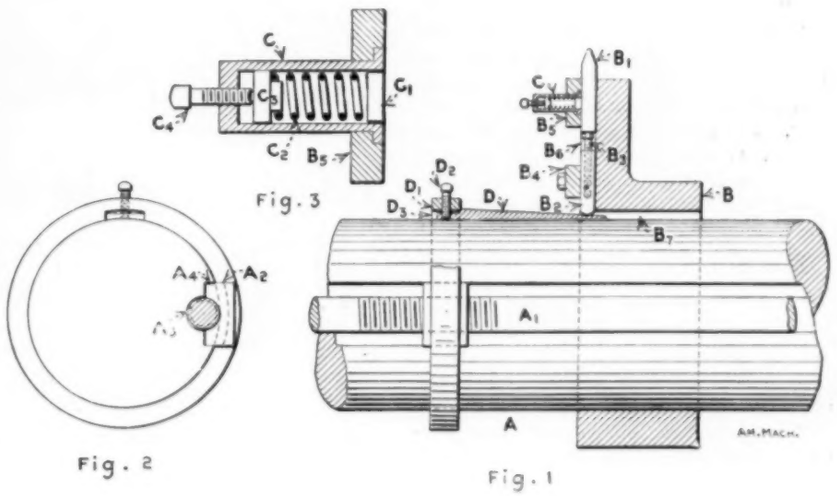
Burlington, Vt.

Boring Bar Taper Attachment for Boring Steel Castings

Having had occasion recently to bore some taper holes in a large steel casting, a tuyere jacket for a blast furnace, and not having a machine large enough to handle the job, the alternative presented itself of either working the taper in with a broad-nose tool in the portable boring bar or devising some practical and easier way of doing it.

I decided on a taper attachment for the portable boring bar which proved entirely satisfactory, making it as easy to bore these holes as if they were straight. Fortunately the shop is equipped with a large surface plate, level with the floor, provided with T-slots for bolts. I clamped the job on this and set up the bar, using two large angle plates which had holes in the one side through which I put the bar and clamped the bearings fast to the plates. In the accompanying diagram I have attempted to make the taper attachment plain.

In Fig. 1, *A* represents the boring bar, grooved in the side for the feedscrew *A* 1 which runs the full length of the bar and is provided with star feed on one end. The groove *A* 3, Fig. 2, is cut semicircular, the radius being slightly



PORTABLE BORING BAR AND TAPER ATTACHMENT

larger than that of the screw, making an easy running fit. The feed nut *A* 2 (half nut) fits in the groove *A* 4, which is central with *A* 3. The feed nut also acts as a key driving tool head.

In Fig. 1, *B* represents the tool head which slides on the bar. In this head is cut the groove *B* 6 in which slide the tool *B* 1 and the block *B* 2. This block is tapped for the capscrew *B* 3, which affords adjustment for the tool. The tool is held in the groove with the clamp *B* 5. This is bored and counterbored to fit the socket *C* shown more painly at *C* Fig. 3.

The clamp *B* 4 holds the block *B* 2 in the groove; the block is made to slide easily in the groove. The tool is also made an easy sliding fit in the groove and under the clamp *B* 5. The clamps are held with two capscrews, one on each side of the groove. In Fig. 1 *D* shows the taper strip which is planed to one-half the required taper in the given distance; this strip is held in position on the bar with the collar *D* 1 tapped for the setscrew *D* 2 which screws down on the end of the taper strip fitted into slot *D* 3 in the collar under the setscrew. This collar is fastened to the bar with two other setscrews which hold it rigid, preventing its sliding on the bar, and, as the shoulder on the large end of the taper strip is tight up against the collar, it too, is kept from sliding.

The slots *D* 3 in the collar and *B* 7 in the tool head must be in line on the bar to prevent the taper strip from binding in the slot *B* 7 as the tool head feeds up over it. Since the taper strip is held fast on the bar and small end entered under block *B* 2, Fig. 1, it can readily be seen that the tool must cut the correct taper. As the tool head feeds along the bar toward the collar, the taper strip forces out the block *B* 2 which, in turn, forces the tool *B* 1 further out of the head. As the tool head feeds up over the taper strip, the strip is taken care of by slot *B* 7. The bar was setting in a horizontal position, and it was necessary to have sufficient pressure on the tool to prevent its sliding or dropping out of the slot when on the bottom side of the bar, starting or finishing the cut.

As the pressure should not be strong enough to hold the tool solid, the device shown in Fig. 3 was used, the socket *C* being fitted in the clamp *B* 5 and placed centrally over the tool. The disk *C* 1 bearing on the tool under the spiral spring *C* 2; between the setscrew *C* 4 and the spring is the disk *C* 3. By adjusting the setscrew the desired pressure on the tool could be obtained, while, at the same time the tool could slide in the slot.

RAY E. WOLF.

Coatesville, Penn.

Machine Indicators to Determine Speeds

Of course everyone knows that speeds and feeds of, say, a driller vary according to the size of the drill, style and size of the machine, its location in the building, class of work, etc., and for this reason it is desirable to have a table or list of feeds and speeds for all varieties of machines.

Everyone is looking for a maximum of work without injury to the tools or machines. As an illustration consider duplicate work on a driller. Of course, the day-work operator must not be depended on for speeds, etc., for every foreman must know the time required to do the work and he should be the responsible party. He must himself determine what speed and feed produce the quality of work sought for with or without the aid of the above-mentioned tables.

With the driller still as an illustration it occurred to me that these difficulties might be overcome if it were designed with a permanent speed indicator attached thereto showing the spindle. This indicator could be attached to swing against the spindle and engage a star-wheel, like a cyclometer. For each change of belt the machinist at first would probably tamper with the indicator, wondering at what speed his machine was running. Such observation would make his judgment of speeds keen and after awhile he would not need the indicator to estimate speeds, but could determine shaft and various other speeds from the indicator giving the spindle speed.

If a drill burns at a given speed the indicator is swung into mesh (for it need not run continually) and the damaging speed determined. The speed and the result ascertained in this way are not likely to be forgotten.

These are some of the advantages. What is said of the driller applies equally well to lathes, planers, millers, etc., but, of course, such indicators would have to be designed to accommodate as many varieties of machines as possible.

WM. KAUFMANN.

Hartford, Conn.

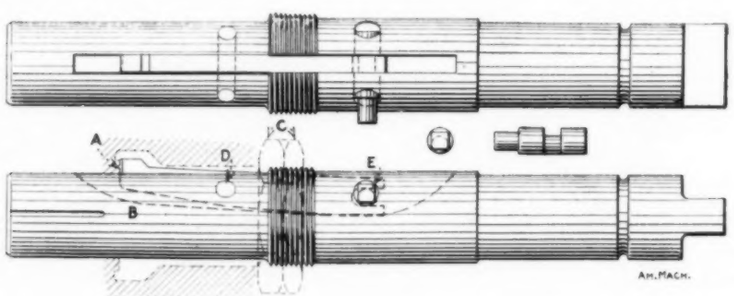
A Facing Tool for Chambered Holes

This is a facing tool made originally for machining the inlet-valve faces of automobile cylinders, as shown in the dotted section *A*, but it may be used for many similar mechanical purposes.

It will be noted that the surface to be faced is larger than the opening to admit the tool, and the tool was designed to meet these requirements. The bar *B* has a pilot which fits the hole used for the valve bushing below the surface to be faced. The bar is also provided with stop nuts or collars at *C* to give a predetermined depth of facing.

The making of the tool is not very expensive, the bar being turned and threaded as shown, and then a slot is cut with a saw, and, if necessary, finished smooth with an end mill; holes are next drilled at *D* and *E*, and after making a pin and a cutter, it is assembled as shown.

In operation, the bar is inserted in the hole and the eccentric pin *E* turned half way around, which sets out the cutter, and the bar is fed down as far as the stop collars *C* will let it go; then the eccentric pin is again turned half way around to draw in the cutter and the bar is removed.



A FACING TOOL FOR CHAMBERED ENDS

ROBERT MAWSON.

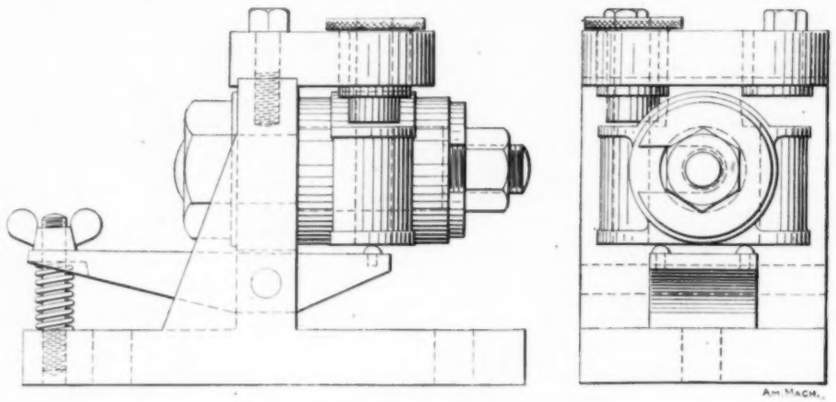
Providence, R. I.

Drilling Connecting-rod Brasses

This jig was designed for drilling the two holes in the rear connecting-rod brass of a gasoline engine. The main body of the jig is of the inverted T-section, the top piece being doweled and held by capscrews. The body carries a shoulder stud, on which the brass is slipped and held while drilling. The nut on the outer end of this stud is small enough to pass through the bored hole, a split washer being used between the brass and the nut, so that one-half turn of the nut is all that is necessary.

The holes must, of course, be drilled perpendicular to the finished face, and to accomplish this the leveling bar at the bottom is used, the forward end of which carries two round-headed hardened rivets, ground parallel to the bottom of the body. This bar is tightened by the thumb-nut at the back, being pushed up by the spring when the nut is loosened.

The holes being quite close together, it was necessary to use a removable bushing, so as to set down into the counterbore.



DRILLING CONNECTING-ROD BRASSES

D. O. BARRETT.

Brandon, Manitoba.

Machining Small Gasoline Motors

We build small gasoline motors for stationary use, and in place of a center crank we employ a built-up crank with steel shaft and crankpin, and cast-iron crank disk. In place of keying the disk to the shaft, we find it cheaper and just as effective to first press the shaft into the disk, then drill into the end—half in the shaft, half in the disk—two holes, which are later tapped, and short-length rods, threaded tight fit are screwed in, serving not only as keys, but to take considerable end load as well.

We had some trouble at first to drill these holes straight down, as the tendency of the drill was to run off into the cast iron. After trying different methods, we finally found that by first drilling a $^{3}/_{32}$-in. hole full depth and following with a straight flute drill—the right tapping size—gave the best results. It seems that in this particular case a straight flute drill has less tendency to run off into the softer metal.

H. C. SUNDELL.

Galesburg, Ill.

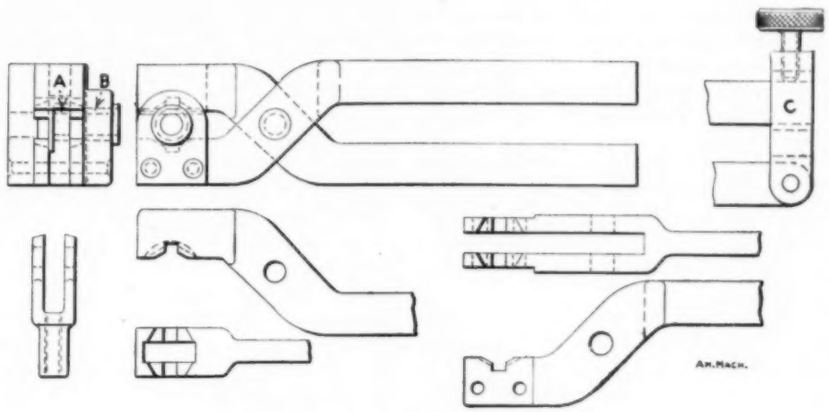
Discussion of Previous Question

Referring to letters and articles previously published

A Handy Drill Jig for Small Parts

C. T. Schaefer's article on page 987, Volume 35, reminds me of a very handy tool which I once designed for drilling holes in the ears of automobile brake clevises.

As shown in the cut the tool consists simply of a pair of tongs, the jaws forming V's to give proper location and two bushings *A* and *B* are provided to insure drilling the holes in line. The tapped end of the clevis is drilled and tapped in a separate operation, preferably on a screw machine, using a common pair of chuck jaws, for where these clevises are manufactured in quantities, it is believed that time can be saved by doing them this way instead of drilling complete in a drill jig and then tapping them.



A HANDY DRILL JIG FOR SMALL PARTS

It is obvious that this tool is very quick acting, as there is no extra clamping, just a grip of the workman's hand, and it is also very easy to keep free of chips. I have used this type of drill jig for a number of small parts where the hole does not bear any particular relation to other holes or parts of the work, but only requires to be drilled central with the boss.

Should the hole require reaming the same kind of a jig can be used, but a clamp should be provided, as both hands are needed when changing tools. One way of arranging this clamp is shown in *C*. If the hole to be drilled is large, it may also be advisable to use this clamp.

Detroit, Mich. GEO. SMITH.

Border Lines on Drawings

I take exception to some of the statements made by Mr. Buffum, in Vol. 35, page 1076, regarding border lines on detail drawings, at least in cases where such drawings are to be in fairly constant use for any considerable time. In my experience the greatest efficiency is secured by putting the border lines on. In the first place there is undoubted economy in having standard sizes for the various sheets that are to be made, for convenience in filing if for no other reason.

Having selected one of these sizes for the sheet in question, we have a border line which may be, say 20x30 in., which acts as the cutting edge for trimming the blueprints, and we add in pencil on the tracing a cutting edge for the tracing only, which secures a uniform size for filing purposes.

This outer border may be approximately 21x31 in. Even this small margin is very useful in pinning down the tracing for making additions or corrections after the sheet has been in use for some time. Unless there is such a border line for trimming the tracings (and it must be uniform for all sheets of a given size) it is practically impossible to get the tracings trimmed to even approximately the same size, and either a very liberal allowance for clearance must be made in the files, or some sheets will curl up on the ends or sides, and some will be so short that a person is very likely to miss a sheet in looking through the drawer hurriedly. Having this small margin outside the ruled border, you can insist on the draftsman keeping his thumb tacks outside the border, adding neatness of appearance to the blueprints.

There are two other advantages in having a small margin on the tracing. One is that the edge of a tracing very frequently curls for ¼ or ½ in. from the edge, or the edge becomes folded back a short distance in inserting in the blueprint machine, and even though it is sometimes possible to straighten it out so that it will remain flat again, the surface of the cloth is injured, so that a whittish place is produced on the prints. The margin helps to keep this outside the blueprint trimming edge, and in doing so to keep it away from the details, which might be obscured thereby. A tear ¼ in. deep, more or less, will frequently occur along the edge of a tracing. This, too, can be repaired before it crosses the border line, and the repair will not show on the prints.

The other advantage is in keeping the details themselves a short distance away from the outside edge of the tracing, independent of border line. A frequent advantage in doing this is noticed when these details have to be erased, as it is a common experience that it is much safer to erase several inches away from the edge of a piece of tracing cloth than within ½ in. of the edge.

There is not only much less chance of tearing the cloth so that it would be impossible to make any corrections on the detail, if you work farther from the edge, but the cloth will stretch much less under the stress of the erasing if you are not too near the edge. Even though the detail near the edge may be corrected successfully, the cloth may be so stretched that it is impossible to get good prints from that section of the sheet.

This may all have principally to do with neatness, but just as cleanliness is closely akin to godliness, we find that neatness is inclined to encourage accuracy, and if I could gain 13 per cent. in accuracy or anywhere near it, at the expense of 13 per cent. more drawer room for my detail sheets, I believe there would be a considerable net gain in efficiency.

E. G. GREENMAN...

Cincinnati, Ohio.

Protesting Mutilation

Concerning the article on page 412, Vol. 35, I cannot imagine Mr. Nosreme cutting out one of the pages of the AMERICAN MACHINIST handbook for the reason that "memory and familiarity" had taught him

that the contents of that particular page had become "less valuable, and obsolete."

Drafting-room data are not different from shop data, and unless an article which has been clipped is later found to be wrong, it should not be destroyed, even should the owner know it word for word. The fact that the reader is a lathe hand does not go to show that he will not be benefited by reading an article describing *other* machines and their methods.

There are no *second* choice articles in the AMERICAN MACHINIST, regardless of what branch of the trade one is in. My experience has been that any article worth publishing in the AMERICAN MACHINIST is worth saving, and instead of clipping certain articles, the staples can be removed, the advertising pages taken out, and the staples put in again. Then index every article in an index book.

Should any article contain an error, such errors are most always corrected in a later number; make a note of the error at the index of the article, with a reference to the page of the correction. Then twice a year your number can be bound in volumes at small cost. This cost and the knowledge that your volumes are complete will more than offset the disappointment certain to come when you are "up against" a problem, data concerning which you remember having read, but which did not seem worth clipping.

C. L. BREEDING.

Batavia, Ohio.

Departures from Standard Practice in Machine Tool Design

I have read with interest Mr. Tuechter's article on the "European Machinery Building Trade," Vol. 35, page 1203. Regarding Mr. Tuechter's statement that in no case did he notice any particular design of standard machine tool differing in its main features from American designs, I wish to point out a few examples that escaped his notice.

The central thrust radial drill made in large quantities by several well-known English and Scotch machine-tool builders, is a conspicuous example of a radical departure from previous standard practice. In this design the spindle is carried *between* the walls of the arm, central with the column, thus eliminating all side twist on the arm, which must occur on all machines having the spindle in front of the arm face.

Another well known firm of lathe builders makes, in large quantities as a standard article a surfacing lathe in which the speed automatically increases as the diameter of the work being turned becomes smaller. Open-side planing machines are made extensively, by an English firm in which the tool moves, while the work is held stationary, the tool carriage being fed by a chain, whereas the usual design consists of a fixed housing and cross rail, and traveling work table.

Several English firms are making planers arranged for double cutting, which contrasts with the universal American single cutting with quick-return planer.

I offer these few examples to show that European designers are developing some standard machine tools independently and on unorthodox lines.

G. A. DEWBERY,
Hamilton, Ont.
Chief Designer, London Machine Tool Co.

About Molding with a Dry Sand Core

I was attracted by an article by M. J. Elder on page 1124, Vol. 34, describing a way of molding a conical shell with the hub on the inside.

From a pattern maker's and also from the foundry standpoint of economy, I think the pattern was satisfactorily made if only a few castings were to be made. The initial mistake of the man whom Mr. Elder saw making the mold was in making it upside down, rather than in the generally accepted way of making such castings.

Had the operator made it in this manner with the inside in the drag, and coping off the outside, thereby having a hollow cope, he would surely have been able to get a cope-flask out of the pile that would clear the pattern, and which would be entirely in the upper flask. Thus the making of special cope flasks with special bars and use of gaggers—all large expense factors—would have been eliminated. Furthermore, with the thin edge of sand in the drag, there would be no roll-over to it once the mold was made, and consequently nothing to shatter the sand and cause it to wash.

When the metal is poured into the mold and the gate cut on the rim, leaving the metal to flow uphill in a smooth rise, a casting far superior to the one molded by the method in the previous article is obtained.

From this same article I get the impression that it is Mr. Elder's idea that the pattern should have been made with a core. To this I would say that the only condition under which I would use a core would be "to cast today" (a frequent occurrence). In this event I would have one man make the core box and another the pattern. Under normal conditions, it would be a shell pattern, as the one criticized, for a few castings; for a large quantity it would be what is termed a "board pattern." That is, the inside on one is board, and the outside on another. the boards being made to agree to a standard flask appropriate for the job in hand. Flask pins are put on these boards inversely to what they are on the flasks, thus completing a molding machine lacking only the drawing facilities and expense.

JOHN P. MANNIX.

Everett, Mass.

Softsoap as a Lubricant

Some time ago a discussion appeared in the AMERICAN MACHINIST on the action of liquids when cutting metal, the point at issue being whether the use of soda water, oil, etc., was as "coolant" or lubricant.

A steamer, in which I sailed for nearly two years, had the thrust block lubricated with softsoap and water; 14 lb. of softsoap and 10 gal. of water being the formula. The mixture was made up with hot condensed water and allowed to cool before use. Each watch one quart of the lubricant was drawn off from cock at bottom of the thrust and one quart of new mixture added. Every 14 days or thereabouts, when in port, the whole of the contents was drawn off and a fresh lot used to fill up.

The bearing ran cooler and gave less trouble than any it has been my fortune to be shipmates with, the only trouble being experienced when a new greaser gave it a dose of ordinary engine oil on the quiet, the churning action of the shaft then making the mixture of the consistency of molasses. The block then rapidly increased in temperature, the mixture being too thick to get between shaft collars and horseshoes.

For the information of any unacquainted with this type of bearing, it is as well to state that the rubbing surfaces are the flat face of shaft collars, the collars being integral with shaft, and the similar babbitted faces of the horseshoe collars, in which ample grooves for lubrication are provided. Pressure between rubbing faces would be 80 to 100 lb. per sq.in, the body of the block forming a bath. The height of the liquid was kept at the center line of the shaft.

Should it be desired to experiment with this lubricant, the conditions of its use, as related, should be carefully noted. Flat surfaces with ample grooves, babbitt and mild steel rubbing together, at least half the bearing being submerged in a bath of the lubricant. The water must be free from hardness.

If I am correctly informed, softsoap is made from vegetable oil, with an excess of alkali. The quality of softsoap used in the above instance was very good, being a light golden color and smelling less unpleasantly than the cleaning variety generally in use. Thickening by the addition of engine oil is due probably to the fact that the oil is mineral, and to the neutralizing of the original excess of alkali in the soap.

London, England. A. L. HAAS.

Manufacturers and Industrial Safety*

By John Calder†

A plea for the manufacturer to make the principles of safeguarding and safe working a regular part of the education of young engineers and foremen.

The state, too, has still a fertile field for improvement in the work of enforcing legislative measures.

*Extract of an address made before the City Club of Philadelphia.

†Manager of the Remington Typewriter Works, Ilion, N. Y.

One of our authorities on industrial mortality, who is connected with one of the large accident insurance companies, and is familiar with the figures throughout the United States, has estimated that the deaths among adult male wage-earners alone, due to accidents, amount to 35,000 a year and that the non-fatal injuries of occupation cannot be much less than 2,000,000 additional.

Such figures take no account of the many accidents to females and young persons and are based on data which are admittedly incomplete and below the mark.

It is staggering to find that in a single year of peaceful industry we kill and wound, without intent, more people than in several great military campaigns where disablement is deliberately pursued with all the engines of war.

From twenty-five years' experience in factories and the investigation of some thousands of accidents, I have found that, for such casualties as are preventable, the responsibility is pretty evenly divided between indifferent employees and neglectful employers.

I believe that factory accidents are due chiefly to the following causes:

Ignorance, carelessness, unsuitable clothing, insufficient lighting, dirty and obstructed workplaces, neglect of fire precautions, defects of machinery and structures, absence of safeguards and, most important of all, lack of safeworking supervision and of instruction of the workmen.

Not all of our accidents, however, are preventable and nothing is to be gained by blinking this fact. Many of them are purely fortuitous and accidental in the most literal sense, no blame being attachable to anyone.

Yet when every allowance is made for inevitability I am firmly convinced from a lengthy practical experience that at least *one-third* of all our factory injuries can and ought to be prevented by legal, administrative and practical measures which I will endeavor briefly to describe and illustrate.

At the outset let me say that this is chiefly a matter for experts with engineering training, though in the United States many such men have yet to be educated, experienced in risks, hired and called upon to show results, not merely or even chiefly in the work of state factory inspection, but as part of the organization in every factory.

The above scientific and practical procedure applies to the whole program of factory safety matters, but I deal solely at this time with accident prevention in relation to machinery. I direct your attention briefly to three aspects of this important matter, viz.:

(1) What the state or "all-of-us"can do.

(2) What the manufacturer can do.

(3) The influence of efficiency on industrial safety.

1. What the State or "All-of-us" Can Do

(*a*) Because of our extensive Inter-State Commerce we need, as far as possible, *Uniform State Safety Laws.* Dangerous machinery and other appliances, both new and second-hand, used in the arts, are constantly moving over state boundaries and such danger as is inherent in the machine itself, apart from its future application, should be provided for by its maker by statutory requirements.

(*b*) The state safety laws should not only be uniform; they should also be definite and practical.

At present the legal responsibility for safety under such laws—often copied unintelligently from foreign statutes or a mangled compromise emerging at the end of a political session—is so tangled that it is sometimes hard for the employer and inspector alike to know where they stand.

(*c*) The remedy is simple. Prepare such statutes under the best expert advice. Keep them nonpartisan and take a step forward, which has long been needed, by removing every permissive clause from these statutes and making the employer—and also the maker of machinery—solely responsible for the guarding of all dangerous parts or appliances which they use or originate, letting proved impracticability be the only defense for nonobservance.

(*d*) Do not attempt to enumerate in the statute all specific dangerous machines—excepting, of course, elevators and common public utilities in structures, in power generation and transmission.

Such a catalog is attempted in nearly every state factory statute we have, but it is always inconsistent and imperfect and prevents progress in industrial safety.

(*e*) Catalog rather in the factory safety law the "dangerous mechanical elements" which are found on machinery and appliances. These are well known to engineers and less than a score in number and comprise the following:

1. All engaging toothed or other gears, rolls, drums and slides of every description on the machine.

2. The spaces between fixed and moving parts at any machine, or between the latter and structures near it, leaving insufficient working clearance—in no case less than eighteen inches—for any person employed thereon or near it.

3. Pulleys and clutches.

4. Belts, bands and driving chains.

5. Flywheels and starting balance wheels.

6. Shafting and spindles and all couplings or projections thereon or upon reciprocating or other moving parts of machines.

7. Counterweights and balance gears and other suspensions.

8. The actual element on every machine which comes into contact with the work, and cuts, shears or otherwise operates upon the latter, for instance the circular saw blade on the sawmill, the punch and die in the press, the revolving cutter in the miller, etc.

Insist in the law that these elements be always guarded where found "unless they are of such form and in such position as to be equally safe to all as if guarded" and you will have without listing thousands of machines a working category of machinery risks. The National Civic Federation has recently adopted this suggestion as the basis of its Model Safety Act.

(*f*) These steps will relieve the factory inspectors entirely of their present impossible burden, viz., their duty in so many dangerous cases to take the initiative and create the obligation on the employer's part by serving notice on him to safeguard. How is a factory inspector, who sees you but once a year, to get an order of what you need?

No possible force of inspectors will make much progress in safety work unless the onus to protect the worker is placed fairly and squarely on the employer's shoulders and on his engineers and on those of the negligent maker of appliances.

(*g*) At present the law practically invites the employer, in many cases of danger, to create risks freely and do nothing toward safeguarding until an inspector, who can only visit the plant once a year at most, happens to make a complaint or recommendation. Even then, if legal process results, it is a long drawn out one with a very doubtful issue, for the judge has a very imperfect statute before him.

(*h*) This unbusinesslike procedure would be swept away at once if the obligation to safeguard rested upon the employer from the moment of starting a dangerous machine and at all times thereafter. Meanwhile the inspector of factories, if he is an expert with a secure and honorable future in the service of the state, which unfortunately is not always the case, has ample scope for educational work especially among the owners of the small plants and for occasional punitive and disciplinary measures based on a clear legal obligation on the employer's part which the courts will respect and uphold.

(*i*) In recent years this task of industrial betterment, owing to the wholly inadequate financial assistance afforded labor commissioners, has been largely performed by our well trained casualty insurance inspectors, so far as their policy holders only are concerned, and by the engineers and executives of many corporations who have given their experience freely to the public.

(*j*) All that has been done recently in several states has been in the right direction. I believe that we should increase the number of engineering experts on the state staffs and should seek to sever for all time the last possible connection of our factory departments with political influence and patronage. It is surely high time to cease making life and limb the playthings of unqualified office seekers. Until this is done no state administration will command the absolute respect and confidence of employers and workmen.

To Sum Up, What Can the State Do in the Premises?

1. It can give us a better, simpler, more scientific and effective safety law and can promote uniform state action on information as to what is actually transpiring in our factories.

2. It can place the safeguarding initiative and obligation fairly and squarely upon the men who create the accident risk, viz.; the employer, the machinery makers and the careless employee and *not* on the inspector as at present; the latter can never be other than an occasional skilled visitor, reporter, and adviser; he cannot be ubiquitous.

3. The state can coördinate through its experts the safeguarding of the best plants in the states—these are our true safety museums—and attempt an educational task, long overdue but not expensive, viz.; the illustration by special bulletin of the various trade risks and their practical remedies.

4. It can provide for compulsory registration of all existing factories and every new factory. I do not favor licensing such places, except in structural fire protection, for accident risks, especially machinery risks, are constantly changing and the creator of these varying industrial dangers should carry the full responsibility for them.

2. What Can the Manufacturer Do?

1. He can see that the principles of safeguarding and safeworking in his industry are made as much a part of the education of our young engineers at college and young foremen in the plants as are those of efficiency and conservation in other directions. So far I have not heard of a single industrial safety course in any school, college or university in the country. Our engineers are turned out without any preparation in this particular. This one duty of education conscientiously fulfilled is fraught with more good to the industrial community than all the statutes ever penned on the subject. With this provision naturally goes the progressive education of the workmen also.

In other words the state may give valuable help but it can never *do* the work. We are asking too much from the manufacturer, whereas the manufacturer determined to have all possible "safety" can get it without asking society or "all-of-us" for any assistance whatever.

2. He can place the responsibility for the safeguarding of his plant upon the mechanical engineer, for the secret of repeated preventable accidents in any plant is an open one, viz.; that whatever is permitted to be anybody's or everybody's business is in daily life, as we well know, nobody's business.

Committees of safety consisting of workmen and foremen may locate accident risks but the design and installation of well considered, consistent, durable safeguards need the close attention of a competent engineer.

In a matter such as this the attitude and action of the mechanical executive of a factory are all important and give the keynote on "safety" to the whole plant.

It is because such a source of betterment, constantly operating has a hundred chances to one over infrequent state inspection for preventing accident, that I desire to see the compelling legal obligation constantly lying upon the employer which has been so successful in the United Kingdom and in Europe.

The Influence of Efficiency on Industrial Safety

In our industrial states there was a time, not so very distant, when a large proportion of the manufacturers took little or no interest in legislative action affecting labor conditions and never reckoned with their responsibilities under the labor laws until worried into doing so.

At that time, particularly in the less populous parts of these states, they were seldom worried and, in spite of the efforts and oft-repeated recommendations of a few able and zealous labor commissioners, the provision for state enforcement of the labor laws was so inadequate that manufacturers in Philadelphia and elsewhere had difficulty in believing that serious observance had been expected by our legislators. A great deal of our legislation is to dress the store window. It has no effect on the laborer or his employer.

At the present day such matters have greatly changed for the better and to an extent that is hardly realized by a public fed largely upon sensation and responding chiefly to lamentable industrial catastrophes.

The best type of manufacturer now looks his legal obligations to labor squarely in the face and plans accordingly. He realizes his moral as well as his statutory responsibilities toward his employees and in many cases exceeds the latter in satisfying his conscience and intelligence regarding the former.

This good work naturally begins at the top but it still needs a resolute campaign of education and demonstration to permeate the great mass of employers in our villages and large cities with a sense of obligation and an appreciation that the way out is now clearly marked.

But the wave of humanitarian interest, which is on the crest at present and will of course, have its variations, is not the only or indeed the chief factor in securing permanent betterment in industrial conditions. A less obvious but none the less real influence is at work behind the scenes which bids fair to make the path smoother for the realization of some labor ideals. The possibilities in improved labor legislation, particularly in hours of labor and safety, are closely allied to and dependent upon improved labor and factory efficiency.

Economic necessity, if not inclination, is already driving the manufacturer to take up in all seriousness the conservation and intensive application of human energies in every department of activity, distributive as well as productive. To succeed in this his factory must be safe, clean, well lighted, heated and ventilated and his employees must be willing to be taught how to attain higher efficiency in a shorter working day. The living necessities of a rapidly multiplying urban population leave us no longer any choice as to whether we shall or shall not intensify the industrial arts.

After a period of great abundance and of great waste of natural resources we are now living upon charity, the charity of the farmer and of every living soul whose efficiency can contribute toward reducing the cost of the necessities of life.

Even the farmer must now rely wholly upon the engineer and manufacturer for the tools of his trade which alone make extensive cultivation possible, and upon the chemist and other scientists for the directions which will enable him to intensify his yield as well.

The population question within our own borders will shortly make these steps imperative, and no legislation or political economy which ignores such needs can possibly stand a trial.

The modern efficiency movement of which you have heard, is far from being a ready-made, stereotyped remedy for every sick business, but it is one with which every manufacturer is bound to reckon.

Making all due allowance for extravagant expectations, and there have been such, nothing but good can come to the commonwealth from the wise application of its principles.

Efficiency implies conservation of our vital assets and the employer's arrangements for reasonable hours of labor, safety, sanitation and compression are all involved in the greater efficiency he seeks. The steps he has to take to attain these most desirable ends tax his organization, his skill of management and his capital far more than they do his workmen who are insured increasing leisure and increasing reward for a new type of diligence.

If the stereotyped and unprogressive "trades," some of which have not moved since the Tower of Babel was built, stand in the way they will most certainly block some of labor's highest ideals, and in the long run will suffer self-destruction.

The progressive manufacturer's organization is deliberately directed toward enabling employee and capitalist alike to make more of the opportunities of the working day under efficient shop conditions which satisfy every reasonable aspiration of labor, and which will make it possible to permanently obtain by scientific coöperation a larger measure of leisure for the workman than legal fiat alone could ever secure.

Our Present Duty

Industrial safety, though a most important item, is only one of a long list awaiting our attention, and neither the iron hand nor a careless generosity will secure improvement. Both are at work, and have failed.

The unsparing exposure during the last ten years of the vulnerable joints in our social armor is certain to continue. It is now reinforced by our best citizens, and is well organized. The motives behind it in the past have been as various as human nature, but a skillful diagnosis of our social ills is nowadays not seldom accompanied by a practicable prescription.

For the evils that afflict our political and industrial affairs today there will be no sensational remedy forthcoming at Washington or anywhere else. They will yield only to the better administration of, and greater respect for, the laws we have to a keener sense of justice, to a greater love for the truth about these things, to greater sympathy and—most commonplace of all—to "patient continuance in well-doing."

We must apply our minds to these subjects as well as our emotions and our means, for, gentlemen, whoever may seem to rule in this nation, the thinker is and always will be its master.

I am going to throw on the screen pictures of a number of safeguards, only a few out of a good many hundreds which are being practically applied every day in a large manufacturing plant employing over 3000 people. Before we throw these scenes on the curtain, I would like to explain that the works in which these safeguards shown around the room and on the slides are used, employ over 3000 people, of whom 560 are females, and on many of these light machines these females work day after day at honorable, skilled and remunerative employment without the slightest danger of accident.

The Remington Typewriter Works include, besides a large amount of stationary equipment, some 1600 machines driven by mechanical power, and about 100 operated by manual power. The works use no patented contrivances for safeguarding the employees. Any device exhibited may be freely copied by any person, and any visitors through the works desiring to copy them is given full information as to how to use them.

The safeguards I am going to show you in all cases except where oil and liquid splash are to be avoided, are uniformly of steel mesh work, reinforced on the edges with sheet steel. A few opaque guards are used, but experience proves that guards are much less likely to be disturbed and laid aside when important working parts of the machinery can be inspected without detaching a guard.

Provision is made in the designing of these guards for the ready detachment, by a person in authority only, of a guard or of any portion of one, for adjustment for repair of machinery. The foundations, or supports of these guards are more or less permanent and are usually undistributed by the necessary removal of accidental parts of the guard. The main point in designing a guard is the study of the real accident risk, when a machine is employed at its ordinary work with the ordinary operators, and then we study to provide a safeguard whose design affords safety, accessibility, machine inspection and durability, and it must not unduly hamper the worker. If possible it should not hamper him at all.

The American submarine "Salmon" has established a record for deep diving, which is said to exceed anything that has been hitherto accomplished in the American navy. During the early summer months, the "Octopus" attained a depth of 125 ft. This has been exceeded by 19 ft. by the "Salmon," which was submerged to a depth of 144 ft. off Prudence Island, and remained at that depth for 20 minutes.

Locating Mechanical Inefficiency through the Power Plant

By C. J. Morrison*

In any manufacturing establishment the power plant is the heart which sends out pulsations through the arteries of pipes, wires, etc. By feeling the pulsations which go out through the various arteries, a good diagnosis of the conditions of the plant can be made. Yet, in very few instances is this important fact used for any practical purpose. In an ordinary shop of the present day, the arteries carry steam, compressed air, water and electricity. Recording gages, placed on these arteries, will reveal an interesting story. In one shop the records showed immediately that the variations at the power house materially reduced the efficiency of the plant and, at the same time, gave the information that the machines were not producing the maximum possible output.

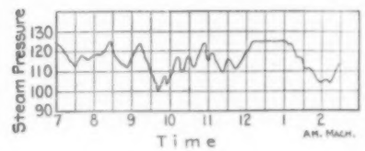


Fig. 1

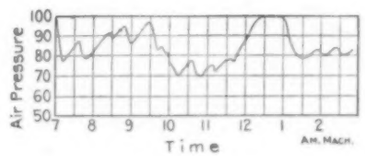


Fig. 2

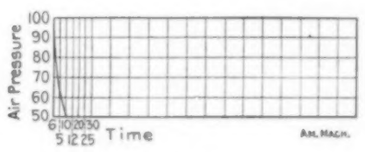


Fig. 3

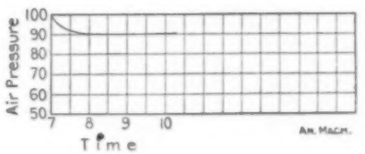


Fig. 4

The steam gage gave an average record, as shown in Fig. 1. The air record was even worse, as revealed by Fig. 2. With all valves closed and the compressors shut down, the record in Fig. 3 was obtained. With all valves closed and one compressor, which gave one-third of the total capacity, running at full speed, Fig. 4 was recorded.

*Manager, engineering department, Suffern & Son, New York City.

Translated: One-third of the entire power of the compressors was being exerted to hold a 90-lb. pressure against leaks in the line. A still further loss was due to moisture in the air. The installation of cooling and reheating tanks and the appointment of a man to stop the leaks, soon overcame the difficulty with the air, so that a month later Fig. 5 was obtained, with all valves closed and the compressors shut down.

The air-trouble man was paid a bonus, depending on the leakage, and soon got the pipes in such condition that the pressure did not drop below 50 lb. at the end of a five-hour shutdown. As the fluctuations in steam pressure were felt to be at the bottom of the difficulty, steps were

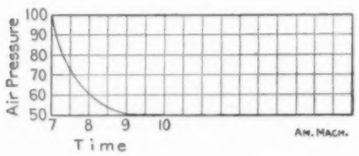


FIG. 5

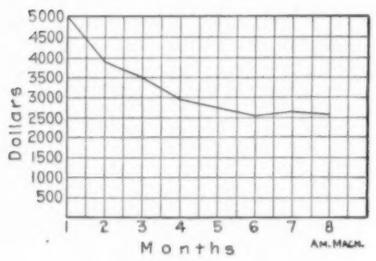


FIG. 6

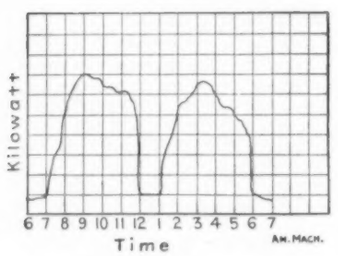


FIG. 7

taken to effect a cure. An automatic draft regulator was installed, and a change made in the grates. These improvements not only gave a steady steam pressure, but reduced the power-plant expenses, as shown in Fig. 6. The power plant was now able to furnish uniform and adequate power, but the shop organization was not prepared to profit by it.

The consumption of electric power for the entire shop, revealing a low efficiency, is shown in Fig. 7. It was at once evident that many of the machines were not started until long after the starting time, and also that many were stopped before time. These records were obtained for each department, and the superintendent went vigorously to work to secure square records. Any foreman whose department was not producing a square record was called upon for an explanation, with the result that at the end of the second month the plant was showing a 10 per cent. increase in output.

This desirable result was obtained with no change in, or disruption of the organization, and the money expended was almost immediately returned by the reduction in power-plant expenses.

An End Driving Dog

BY ROBERT J. SPENCE*

In grinding straight, cylindrical work, it is customary to grind up as close to the driving dog as possible, then reverse the shaft, fasten the dog on the other end and grind the short end that remains where the dog had been. Those who have had much production grinding to do, know how difficult it is to grind this short end concentric with the other ground portion, on all work except short, rigid pieces.

The accompanying charts show an end-driving dog, which has been used successfully for some time. The figures given are those required for a dog used on a 10-in. Norton plain grinder. The same style, however (of course, with changes in dimensions), can be used on any grinder or lathe.

The assembled dog, with its special center, is represented in Fig. 1. *A* is the dead center; *B* is the part that revolves on the center; *C* is the driver and fits into

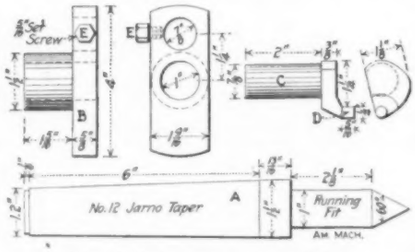


FIG. 2. DETAILS OF THE DOG

the slot on the face-plate of the headstock; *D* is the driving pin. A small piece of work is shown on centers with the driving pin engaged in a hole drilled to receive it. The dotted lines represent a much larger piece of work with the driver swung around to engage the hole.

*Machine shop instructor, Westfield Independent Industrial School, Westfield, Mass.

This illustrates the wide range of the dog, but naturally a small driving pin limits the range to small work. The diameter of the pin should be proportionate to the diameter of the work. The setscrew *E* binds the driver in place when once set, and also permits a horizontal adjustment in case the center holes in the work are not all of the same depth. The driving pin should be a trifle smaller than the hole. The dog in detail is shown in Fig. 2. Fig. 3 is a drill jig for drilling the holes in the end of the work. By using

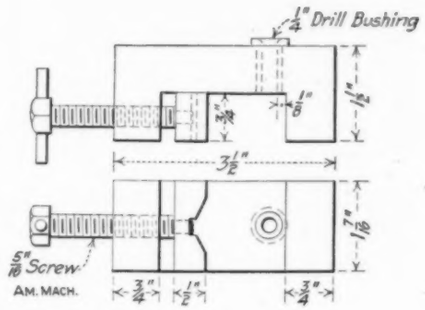


FIG. 3. THE DRILL JIG

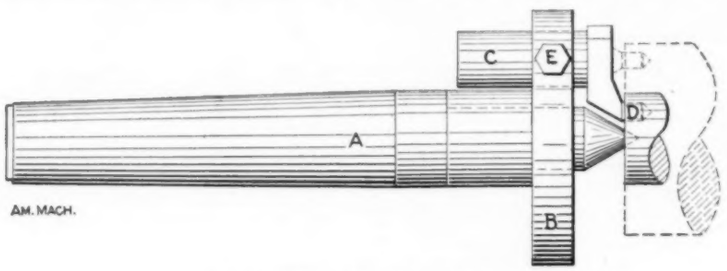


FIG. 1. THE ASSEMBLED DOG

this jig duplicate holes may be obtained, so that the driving pin will not need to be adjusted for each piece, provided that, in setting, enough clearance is given the driving pin by the horizontal adjustment to allow for the variation in the depth of the center holes.

The figures here given limit the size of the work taken by the jig to small diameters. A good plan is to have a longer jig that would take in both large and small diameters, with several loose bushings for different diameter holes.

According to its origin and the conditions under which it accumulates, peat may vary in color from brown to black. In texture it may vary from light, spongy matter that is porous, coarse, fibrous, or even woody, and easily falls to pieces when dry, to forms that are nearly or quite devoid of structure, and when wet are as plastic as clay and when dry form dense, hard masses resembling lignite. In all cases, as noted above, peat is nearly or quite saturated with water, containing, under usual natural conditions, from 80 to 95 per cent.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.

Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1911, 1,358,200 copies. For January, 1912 (American weekly, American monthly, English weekly and German weekly), total, 92,750.

Of this issue, 19,750.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 165

American Machinist

Repair Parts

In a machine shop where manufacturing is highly organized, where parts are made in large lots with jigs and fixtures for the various operations, the question of how best to handle repair parts may not be easy of solution. Parts for machines of present design can be shipped from stock. But usually there are not many of these. Repair orders are too often for parts of old machines built many years ago, before jigging was common and before manufacturing methods had become highly developed. In many cases, the original patterns for cast parts have been destroyed or changed over to other designs.

Thus it follows that the parts for many repair orders must be made under job-shop conditions. This is expensive. Again, such orders hinder the regular order of work if on a manufacturing basis, and also tend to hold back the regular production, thus increasing the cost of the regular product.

These are two good reasons, from the shop owner's viewpoint, why orders for repair parts are not desirable in a shop on a highly organized manufacturing basis. A third is the final cost of the parts produced. Because of the job-shop conditions under which they are made, the cost of a given part must be greater than for a similar piece turned out under the regular manufacturing methods.

On the other hand, the customer does not know that his order is a disturbing element, and is inclined to look upon his bill as too high. Being in the machinery-building business, he often thinks that he knows what such a part should cost.

Thus we face this situation: The repair order for an out-of-date part may be a nuisance in a manufacturing machine shop that accepts it; its cost is apt to be so high as to displease the customer; yet the shop cannot refuse to supply parts for machines it has produced in the past and still hope to have and keep satisfied buyers.

If a shop has a sufficient volume of such orders, the establishment of a separate department to hand them will prevent any disturbance of the regular run of work. Taking care to control and keep down the costs of such parts will help to keep the customer happy when he gets his bill. If, at the same time, it is explained to him that the parts for his old machines must be made under job-shop conditions, with a consequent increased delay and cost over parts for more modern machines, he should be still further satisfied.

The customer is entitled to receive his repair parts within a reasonable time, and at no greater expense than all the conditions warrant. The machine-shop proprietor cannot afford to disturb his regular shop work unduly, and is entitled to a profit on all the work he turns out. He likewise has a duty to fulfill toward the buyer of his machines; he should help him keep them running; and as satisfied customers are often called a firm's best salesmen, some machine builders consider that repair parts should be furnished at but little over cost.

Patent Office Needs

The congested condition of work in the Patent Office and the many antiquated methods there in use might hold that important branch of public service up to severe censure for allowing such a condition to exist if it were not for the fact that the Patent Office authorities have themselves repeatedly pointed out the unsatisfactory condition and urged Congress to provide a remedy. The congestion of work became so great in 1906 and the pressure for relief so urgent that President Roosevelt personally took a hand in an attempt to relieve the situation.

At this time there were over 23,000 cases in the office awaiting action, resulting in a delay of from five to nine months in each particular case. As a result of overtime work and all the enthusiasm which could be instilled into the department by the Commissioner of Patents and other officials, cases in arrears were brought down by February, 1907, to under 10,000. This apparent gain, however, was not real because many of the actions were so superficial as to result in double work later, so that from that time on up to the present the number of cases has again been increasing until now there are over 18,000 awaiting action.

One cause of this unsatisfactory condition was, up to a recent date, the small pay of the employees, causing them to use their positions as stepping stones to more remunerative work outside as soon as they had had sufficient experience to become useful. After repeated and constant pressure Congress provided for some increase in salaries which, while still inadequate, has been of some help in retaining experienced and efficient men in the examining forces.

The Patent Office building and its furnishings are far from suited to, or adequate for, conducting the required business and for the suitable storage and classification of reference patents. The fact that the Patent-Office department has proved profitable to the government and that there is a large fund standing to its credit has seemed to give force to the repeated appeal for a new building. Unfortunately simply pointing out the needs has not in the past been sufficient to bring about the desired results when dealing with Congress. This is a case where the mechanical interests should combine to bring such additional pressure to bear upon Congress as will give relief.

An instance of the niggardly policy pursued by the government is in classifying the German patents. This work was started and duplicate copies secured so that they could be mounted and filed by classification to aid in searching in a particular art. This is especially important because in the volumes of the early German patents the drawings are usually folded and any general search must, therefore, be extremely slow. We are informed that an appropriation of only $800 would have completed this work which has now lain for years in an incomplete state and not available for use and Congress failed to make this trifling appropriation. It would also be very desirable to have such a classified set of the French patents.

If there could be a classification of the United States patents similar to the

classified abridgments of the British patents which date back to 1855, each volume covering a period of years and being in convenient form for rapid reference, it would aid greatly in making searches without visiting the Patent Office. These volumes of British abridgments can be obtained for a shilling apiece. If such classified abridgments of the United States patents were available it would greatly reduce the labor and expense of making a search and would react to reduce the work of examination because new applications could be prepared with a better knowledge of the prior act.

Another important need is for the establishment of a Patent Court of Appeals and a readjustment of the laws governing litigation so as to avoid the present long, drawn-out and expensive methods; methods which leave the outcome in doubt sometimes for years.

This whole patent matter should be gone into from the foundation up and be put on a modern basis of efficiency.

Compulsory Education for Pattern Makers' Apprentices

An interesting development of the industrial-education problem is the agreement between the Board of Education of the City of New York and the Pattern Makers' Association of that city.

By this agreement, all apprentice pattern makers will have to attend public evening school, where a course will be given them under the joint supervision of the school authorities and a committee of the union, and from which certificates and diplomas for satisfactory work will be issued bearing the seals of the Board of Education and the Pattern Makers' Association.

The school committee of the union will investigate the work and attendance of the apprentices and make reports on the subjects of discipline and curriculum. If the courses are overcrowded, members of the union are to be given preference in the matter of admission, although the courses shall be free to the public.

The Pattern Makers' Association has shown its progressiveness on previous occasions, and is to be congratulated on its present move.

Baush Machine Tool Co. Changes Hands

The Baush Machine Tool Co., Springfield, Mass., has undergone reorganization, and the controlling interests have changed hands.

In the new organization C. K. Lassiter is president; Walter Foster, secretary-treasurer; J. A. Eden, Jr., manager, and C. A. Smith, superintendent. Frank H. Page, for the past two years head of the company, retains a substantial interest.

The capital stock has been increased to $1,500,000, and the company will widen its line of manufacture.

Technical Book Publishing

The McGraw-Hill Book Co. announces the completion of arrangements for the sales agency of the technical books of the *Railway Age Gazette, American Engineer* and *Signal Engineer*. This makes the McGraw-Hill Book Co. publishers and distributors of books for the three journals, but it does not affect the publication of the papers themselves in any way.

With the addition of these three papers in the railroad field, the McGraw-Hill Book Co. now publishes books for the twelve leading American engineering papers in the fields of civil, mechanical and electrical engineering, electric and steam railroading, machine tools, mining, metallurgy, chemical engineering, etc.

Proportions of Miter and Bevel Gears

With this issue the series of tables published in the past few issues, covering the proportions of miter and bevel gears, is completed.

Through inadvertence in this office the uniform column heading given the tables may lead to some confusion. It should have more properly been "Proportions of a . . . . Tooth Gear to Mate with the Gears Given in the Left-hand Column."

New Publications

VALVES, VALVE GEARS AND VALVE DIAGRAMS. By Franklin DeR. Furman, M. E. 125 pages, 8x10 in., 152 illustrations. Published by the Author, Hoboken, N. J. $3.75.

The author is professor of mechanisms and machine design at Stevens Institute of Technology, and the book is the outcome of a set of notes originally issued eight years ago and revised as occasion demanded. The material has, for the most part, been arranged for classroom and recitation, although many drafting-room problems in valve designing are given and carefully worked out.

It begins with the simple steam-engine and slide valve, and analyzes the movements by Zeuner, Bilgram and Reuleaux diagrams. Different types of valves, such as the Allen, Meyer and Buckeye, are taken up in detail, while the various valve gears, which have become a part of valve history, are shown in all necessary detail. The list includes the Gooch, Allen, Corliss, Link, Porter-Allen, Walschaert, Hackworth, Marshall, Joy, Baker, Stevens and Lentz, as well as those used in steam-turbine work.

While they are necessarily taken up in considerable detail, this adds to, rather than detracts from, their value to draftsmen and others who have to do with valve-motion study and design. The link motion and its modifications receive considerable attention, making it appeal especially to railroad men. Governors which act through the valve gearing are also studied, making it very useful to the stationary-engine designer as well. We might wish the book was of standard size, but this does not affect its value to all who are interested in the subject.

Personals

Howard W. Evans has been appointed general sales manager of the Best Manufacturing Co., Pittsburg, Penn. Mr. Evans was formerly connected with the Crane Co. of Chicago, Ill.

C. R. McCullough, formerly connected with the Packard Motor Car Co., has joined the sales organization of Manning, Maxwell & Moore, and will make his headquarters in Detroit.

Geo. B. Pickop, until recently master mechanic, P. &. F. Corbin, New Britain, Conn., has been appointed general superintendent of the Universal Machine Screw Co., Hartford, Conn.

L. H. Mesker, who has heretofore been connected with the Cleveland branch of Manning, Maxwell & Moore, has been appointed manager of the St. Louis branch of this corporation, succeeding C. L. Lyle.

Frank P. Smith has joined the sales organization of Manning, Maxwell & Moore, and will devote his chief efforts to the railway department. Mr. Smith was formerly connected with the same corporation.

Arthur D. Little, president and general manager of Arthur D. Little, Inc., chemists and engineers, Boston, Mass., was elected president of the American Chemical Society at its annual meeting at Washington. He was vice-president of the society and chairman of the Division of Industrial Chemists and Chemical Engineers.

Arthur H. Gill, associate professor of experimental engineering at the Pennsylvania State College, has resigned to accept an offer in the industrial field. Prof. J. P. Calderwood has been assigned charge of the experimental laboratories in his place, and R. M. Pennock has assumed Professor Calderwood's classes in heat engineering.

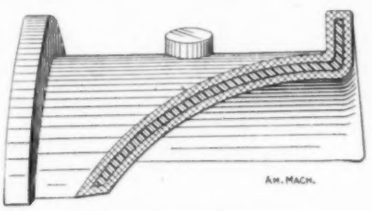
C. W. Cross, superintendent of apprentices of the New York Central lines, with headquarters in New York, has been transferred to Chicago, where he will be in charge of the apprenticeship system on the New York Central lines west of Buffalo. Henry Gardner, now assistant superintendent of apprentices, will be in charge of apprenticeship work on the lines east of Buffalo, with headquarters in New York.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

Reinforced Bearing

The accompanying illustration shows a reinforced die-cast bearing, consisting



A Reinforced Bearing

of a steel core, tinned, to insure union with the surrounding babbitt.

It is a recent product of the F. C. Morrison Manufacturing Co., 302 Broadway, New York City.

Factory Vacuum Cleaner

The vacuum cleaner shown in the illustration was designed for factory application, especially for renovating prior to whitewashing.

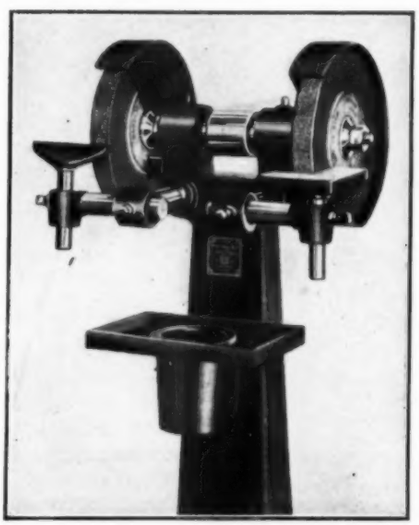
The machine has ample dirt capacity for ordinary factory requirements, and the usual factory wiring enables the operator to connect the motor at various points as he proceeds with his work.

The machine can be equipped with direct or alternating current motors and is manufactured by Hanlon & Wilson, Wilkinsburg, Penn.

Tool Grinder

The tool grinder shown is equipped with Hyatt roller bearings.

The spindle is made of machine steel, ground, and the water pot is placed in a



Tool Grinder

convenient location for the workman, resting on a suitable table for holding tools, etc. The bearings are oiled through dust-proof cups which are sunk in the shell of the bearings.

The base measurement of the machine is 14x12½ in., the spindle is 13⅞ in. long with a diameter of ¾ in. in boxes. The machine weighs 96 lb. and is a recent product of the W. W. Oliver Manufacturing Co., Buffalo, N. Y.

Grinder and Lathe Dogs

A drop-forged steel grinder dog, manufactured by the Page-Storms Drop Forge Co., Chicopee, Mass., is shown in Fig. 1.

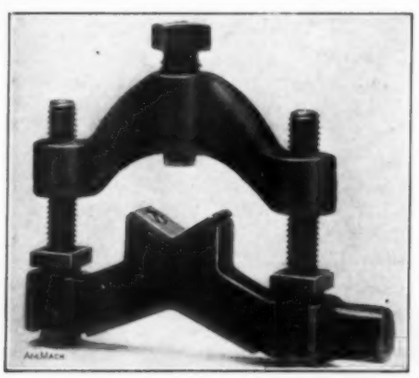


Fig. 1. With Brass-lined Jaw

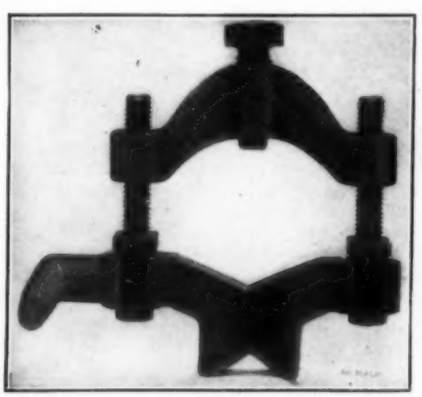
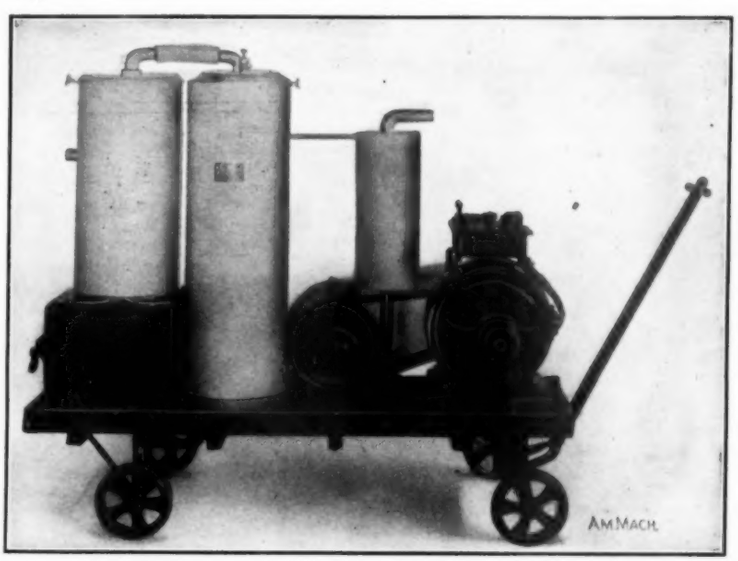


Fig. 2. For Use in Lathe

The jaw of this dog is lined with brass, so that it will not mar finished work. It is also reversible, as shown in the lathe dog illustrated in Fig. 2; this considerably increases the capacity of each size dog.

The dogs are made in four sizes, 1½, 2½, 4 and 6 in., either for use in the grinder, as shown in Fig. 1, or for the lathe, as shown in Fig. 2.



Vacuum Cleaner Designed for Factory Use

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

Metal Working

NEW ENGLAND

Dr. G. Fred Hart, Webster, Mass., will erect a large commercial garage near Mechanic St.

E. A. Dexter, Springfield, Mass., will erect a garage at 113 Bond St., to cost about $16,000.

The garage, at 41 Stanhope St., Boston, owned by Frank Braley, was damaged by fire, Jan. 31. Loss, $4000.

The Baush Machine Tool Co., Springfield, Mass., will enlarge its plant and new lines of machinery will be manufactured.

The Acme Wire Co. is building a brick machine shop at their plant, on Whitney Ave., New Haven, Conn. It will be 20x30 ft., one story high.

The Stevens-Duryea Co., manufacturer of automobiles, will erect a factory in East Springfield, Mass. The building will be 500x80 ft.

The Niles-Bement-Pond Co., Boston, Mass., has been incorporated with a capital of $25,000 to manufacture machinery. The incorporators are M. Chase, H. M Cleaver and E J. Edwards, Jr.

The Taunton & New Bedford Copper Co., New Bedford, Mass., has asked for bids for the construction of a new rolling mill to be located on North Front St., between Wamsutta and Logan Sts.

MIDDLE STATES

The Macomber-Whyte Wire Rope Co. will erect a plant at Kenosha, Wis.

The United States Steel Corporation will erect a new steel mill at Donora, Penn., to cost $200,000.

The Pennsylvania R.R. Co. will buy machine-shop equipment for new dock shops at Cleveland, Ohio.

A commercial garage will be equipped by the Judd Auto Co., at Cleveland, Ohio. J. F. Judd, Jr., is manager.

The Motor Truck Express Co., of Cincinnati, Ohio, will equip a large garage. Harry J. Janson is manager.

The machine shop of the Camden Shipbuilding Co., Camden, N. J., has been damaged by fire. Loss, $10,000.

The Pennsylvania R.R. Co. will erect a roundhouse at Indianapolis, Ind. D. P. Beach, Indianapolis, is division engineer.

The Rogers Mine, in Bates Township, Iron River, Mich., will construct a boiler and engine house, machine shop, etc.

The machine and blacksmith shops of the Standard Plate Glass Co., South Butler, Penn., were destroyed by fire, Jan. 27. Loss, $40,000.

The metal house of the Eagle White Lead Co., Hunt St. and Broadway, Cincinnati, Ohio, was destroyed by fire, Feb. 2. Loss, $75,000.

The Troy Carriage & Wind Shield Co., of Troy, Ohio, will equip its plant for the manufacture of speedometers and automobile lever locks.

James Cunningham & Sons will build a four-story brick garage at 2341-45 Michigan Ave., Detroit, Mich., to do a general repair business.

The Ohio Machine & Boiler Co., Cleveland, Ohio, has been granted a permit for the erection of an engine and boiler room at 1503-15 University Road.

The General Fireproofing Co., of Youngstown, Ohio, will erect a four-story addition to its steel furniture plant. W. H. Foster is president.

The Buffalo Crushed Stone Co., Buffalo, N. Y., will build and equip a blacksmith shop and a boiler house at its plant on the Erie R.R., near Main St.

William J. Lyles, Jr., Middletown, Ohio, will erect a plant at Nashville, Tenn., for the manufacture of malleable iron and steel castings. Estimated cost, $200,000.

The Anderson Tool Co., Anderson, Ind., will receive bids for the construction of a plant to take the place of the one recently burned. C. W. Hooven is president.

The boiler house, coal breaker and scale house at the colliery of the Connell Anthracite Mining Co., Bernice, Penn., were destroyed by fire, Feb. 2. Insurance, $160,000.

The H. Lange Wagon Co., Pittsburg, Penn., has organized the Lange Motor Truck Co., and has taken over a building at 145 St. Clair St., to remodel and equip for the manufacture of automobiles.

The Baltimore & Ohio R.R. Co. will erect shops and a roundhouse on Quincy St., Garrett, Ind. As soon as plans have been completed bids will be asked. A. M. Kinsman, Cincinnati, Ohio, is engineer of construction.

The Vulcan Manufacturing Co., Fond du Lac, Wis., will enlarge its plant. New equipment, including one 10-ton and four three-ton electric traveling cranes will be purchased. Ulrich Anderson is superintendent and general manager.

Fire destroyed the gelatine works of Kind & Landsmann, at Fifth St. and the Delaware River front, Camden, N. J., and damaged adjoining properties occupied by Levi J. Troth, storage warehouse, John L. Mills, machine work,s and the Woods Marine Machinery Co. The loss is estimated at $100,000.

The Gray Manufacturing Co., Buffalo, N. Y., incorporated with a capitalization of $30,000, will establish a plant for the manufacture of motor trucks for serving annealing ovens in malleable-iron foundries and other specialties. T. Gray, B. B. Pannett and E. C. Randall, 615 White Building, are the incorporators.

The Pratt & Letchworth Co., Buffalo, N. Y., is having plans prepared for a malleable-iron foundry building, 225x550 ft., one story, brick and steel, which it will add to its plant at Tonawanda St., Military Road and the New York Central R.R. Electric traveling cranes and hot-air heating system utilizing waste heat, will be installed.

The Youngstown Sheet & Tube Co., of Youngstown, Ohio, has made formal announcement of a portion of its plans for the enlargement of the finishing mills in East Youngstown. A small plate mill and an 8- and 10-in. hoop mill will be added. The mill will manufacture keg and barrel hoops and light bands, while lighter hoops and jobbing sizes will be made in the 8-in. mill. Pile foundation will be driven next week for the new openhearth furnaces at East Youngstown.

SOUTHERN STATES

A plant will be erected at Nashville, Tenn., by the Ezell Scientific Plow Co., of Nashville, to manufacture plows and other metal products.

The Kanawha Mine Car Co., Charleston, W. Va., is contemplating the construction of an addition to its plant, at Charleston. Estimated cost, $15,000.

The Taylor Motor Co., of Lynchburg, Va., has awarded a contract to John & Adams, Lynchburg, for erecting a garage, salesroom and machine shop, to cost $15,000.

The Birmingham Metal Products Co., of Birmingham, Ala., recently incorporated, with a capital stock of $35,000, has leased a building on Ave. E, between Eleventh and Twelfth Sts., and will begin the manufacture of spiral locked joint corrugated metal culverts, corrugated tanks, cisterns, garbage cans and other metal articles within the next 30 days. Solon Jacobs, J. H. Dean and H. O. Barnard are the incorporators.

Bids are asked until 10 a.m., Feb. 27, by the Paymaster-General, United States Navy, Chief of the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing machine tools as follows: Schedule 4331, Class 51, one vertical drilling machine, 50 in., with special attachment for tapping; Class 52, one hydrostatic wheel press, 96-in., 400-ton, motor driven; Class 53, one vertical milling machine, motor driven and fitted with rotary attachment, all for delivery at the Charleston navy yard.

Maj. F. C. Boggs, Corps Engineers, U. S. A., General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., will receive bids until 10:30 a.m., Mar. 1, for general control apparatus for the lock machinery, Panama Canal, including starting panels for all motors, which are to be controlled from a remote point; limit switches, commutating switches used in the miter-gate control, auxiliary cutout switches for miter-gate strut, handrail controllers, miscellaneous remote indicators and indicator controllers, control switchboards for all locks and spillways and control and indicating apparatus for the chain fenders.

WEST OF THE MISSISSIPPI

A new machine shop is being erected by W. L. Folden at Beatrice, Neb.

A plant will be erected at Nebraska City, Neb., by the Eclipse Ore Reduction Co.

A plant for the manufacture of tanks and boilers will be erected, at East Omaha, Neb., by Keely Bros., Omaha.

The Hastings Foundry & Iron Co., Hastings, Neb., is considering doubling its steel works and enlarging its foundry and machine shop.

The shops of the St. Louis, Brownsville & Mexico Ry. Co., at Kingsville, Tex., will be enlarged. R. B. Fowler, Kingsville, is superintendent.

The factory of the Waterloo Drop Forge Co., Waterloo, Iowa, was completely destroyed by fire, Jan. 31. Loss, $75,000. Insurance, $17,500.

The car shop of the plant of the Standard Oil Co., at Sugar Creek, Mo., was destroyed by fire, Jan. 26. The loss was $15,000, covered by insurance.

A building has been leased by the George W. Johnson Manufacturing Co., Kansas City, Mo., in which to manufacture iron doors and fire escapes.

PACIFIC COAST

The installation of a municipal repair plant and blacksmith shop is being considered by the city of Portland, Ore.

Fire damaged the plant of the American Ever Ready Battery Co., at Third and Shipley Sts., San Francisco, Calif., on Jan. 26. Loss, $2000.

The Pacific Metal Co., Los Angeles, Calif., recently incorporated, to manufacture tools, etc., will erect two buildings for the manufacture of its product.

The Northern Pacific Ry. Co. will receive bids for its proposed buildings at Parkwater, Wash., east of Spokane, consisting of a 37-stall roundhouse, machine shop, car shop, supply house, coal bunkers, ice house, store house. J. D. Koren, Spokane, division engineer, is in charge of the work.

CANADA

The Sussex Motor Co. will erect a new factory at Sussex, N. B.

The St. Lawrence Welding Co., Montreal, Que., will equip a new plant.

The Steel Co. of Canada will erect a new boiler house at Hamilton, Ont.

The Victoria Garage Co., Ottawa, Ont., will equip a new garage and repair shops.

The Canada Foundries & Forgings Co., Montreal, Que., will erect a large new plant.

McGregor & McIntyre, Pearl St., Toronto, Ont., will erect a new foundry, to cost $50,000.

The James Robertson Co., Toronto, Ont., will equip a large new factory and molding plant.

O. J. Edinger will build a large new garage and repair shops on Whyte Ave., Edmonton, Alta.

C. S. Boone will equip a big new garage and repair shop at 142 Crescent Road, Toronto, Ont.

Bids will be asked for an addition to the engine house of the Chatham Gas & Electric Light Co., Chatham, Ont.

The Rumely Machine Co., Laporte, Ind., will erect a plant at Calgary, Alta., for the manufacture of gas traction engines.

Plans are being prepared for a foundry and machine shop at Bridgeburg, Ont., for the Tuttle-Bailey Manufacturing Co., Cleveland, Ohio, manufacturers of ferro-steel heating registers.

GENERAL MANUFACTURING

NEW ENGLAND

The Machias Manufacturing Co. is erecting a new mill at Machias, Maine.

The Arlington Creamery Co. will build a new creamery this spring, at Arlington, Maine.

The Bentley Stop Motion Co., Dracut, Mass., will erect a blacksmith shop for automobile repairing.

The Elm City Ice Co., New Haven, Conn., will construct a new frame ice house, 40x170 ft., 30 ft. high, with shingle roof.

Fire damaged the power plant of the United States Finishing Co., Pawtucket, R. I., destroying the old boiler room. Loss, $10,000.

Gardner, Mass., will expend $5000 for improvements to its pumping station for its water supply. A large new pump will be installed.

Work will be begun early in the spring on the addition to the rolling mills of the Taunton & New Bedford Co., on North Front St., New Bedford, Mass.

Plans are being prepared by Architect E. M. Stone for an addition to the Empire Steam Laundry, on Sheldon St., Hartford, Conn. It will be of brick, 36x129 ft., two stories high.

The Swiss Cleansers & Dyers, Inc., Springfield, Mass., have purchased the three-story factory at 10 Hayden Ave. and will install complete modern equipment. C. J. Rishor is president.

The Moore Drop Forging Co., Springfield, Mass., announce that they will construct a one-story, 70x115-ft. addition to their plant, of mill construction. They are in the market for machinery.

Plans have been completed by Carlson & Koletzsky, 16 Daggett St., New Haven, Conn., for the construction of a factory building for their use, at 272 West Water St. It will be two stories high, 25x72 ft., and of mill construction.

Plans of Architect David Bloomfield, of Meriden, Conn., have been completed for the proposed addition to the plant of the Beaton & Corbin Manufacturing Co., Southington, Conn. It will be 36x78 ft., of brick, two stories and basement.

The Connecticut Mills Co., Danielson, Conn., will double their present capacity by occupying the factory formerly used by the American Oil Engine Co., which has been leased for a term of five years. New machinery is to be installed for the manufacture of automobile-tire duck.

MIDDLE STATES

The M. A. Gedney Pickling Co. will enlarge its plant, at Cumberland, Wis.

The Sash Hanger Manufacturing Co., Wellsville, Ohio, will build a new plant.

The city of Cleveland, Ohio, has started work on a $2,000,000 electric-lighting plant.

The Galion Iron Works Co., Galion, Ohio, will make improvements to its plant.

The Humphrey Pipe & Foundry Co., Bellefontaine, Ohio, will build additions to its plant.

The Kinsman Telephone Co., Kinsman, Ohio, will buy equipment for a new telephone plant.

The Polar Ice Co., Indianapolis, Ind., will make extensive additions to its power plant.

The Plant of the Camden Gelatine Co., of Camden, N. J., was destroyed by fire. Loss, $100,000.

The New Johannesburg Cheese Factory, New Richmond, Wis., was totally destroyed by fire.

The plant of the Ford Bottling Works, Lake St., Geneva, N. Y., was damaged by fire, Feb. 1. Loss, $1500.

The cigar-box factory of T. A. Meyers, York, Penn., was destroyed by fire. The estimated loss is $60,000.

It is said that the Great Western Pottery Co., Tiffin, Ohio, will erect an additional kiln in the spring.

The Marmette Excelsior Wrapping Co., Marmette, Wis., will build a two-story, 62x90-ft. plant, this spring.

Improvements will be made to the Westerville, Ohio, electric-light plant, which is owned by the city.

The Bond Bottle Sealing Co., Wilmington, Del., are having an addition built to their plant, at 501 Monroe St.

An explosion in the plant of the Heyden Chemical Works, at Garfield, N. J., caused damage of about $50,000.

Fire destroyed the factory of the Vogel Cabinet Furniture Co., 222 East Thirty-seventh St., New York City.

The Claycraft Brick Co., Columbus, Ohio, has raised its capital to $150,000, and will buy new power equipment.

Fire damaged the trunk factory of S. Grossman & Co., at 720 Fifth Ave., Pittsburg, on Jan. 30. Loss, $17,000.

The Graff Seamless Shoe Co., of Ithaca, N. Y., manufacturer of athletic shoes, will move its plant to Saginaw, Mich.

The Western Telephone Co., 219 South Clinton St., Detroit, Mich., has been damaged by fire to the extent of $20,000.

The Peerless Manufacturing Co. will build an addition to its plant, at 1945 East Willard St., Philadelphia, Penn.

The plant of the Austin Knitting Mill, South Bethlehem, Penn., was recently destroyed by fire. The loss was $150,000.

The Farmers' Elevator Grain & Supply Co., New Bavaria, Ohio, will erect a new grist mill. J. Nornung is manager.

The American Filler Co., Vincennes, Ind., will erect new buildings and give employment to at least 50 more people.

The two-story brick factory at 720 Fifth Ave., Pittsburg, Penn., owned by S. Grossman, was burned, Jan. 30. Loss, $25,000.

The plant of the Acme Manufacturing Co., Forty-fifth Ave. and Cortlandt St., Chicago, Ill., was destroyed by fire, on Jan. 24.

Plans have been drawn for an addition to the municipal power plant, at Newcastle, Ind., including new pumping equipment.

The five-story building occupied by the Columbia Cork Co., at 163 Bowery, New York, was damaged by fire, Jan. 30. Loss, $2000.

The International Harvester Co. is installing a new power plant at its Weber

Works, Eighty-first and Wallace Sts., Chicago, Ill.

The Peerless Silk Hosiery Co., Willard and Jasper Sts., Philadelphia, Penn., has let a contract for a large addition to its plant.

The Canton Brush & Broom Co., Canton, Ohio, incorporated for $100,000, to equip factory and make a line of brushes and brooms.

The plant of the Stemmerman Photo Craft Co., Passaic, N. J., was burned, Feb. 5. Loss, $20,000, partially covered by insurance.

Frederick Stearns & Co., of Detroit, Mich., manufacturers of pharmacal preparations, are to erect an addition to their factory.

The Alldermann-Fairchilds Co., Rochester, N. Y., will soon begin the construction of a factory building, 164x264 ft., on Orchard St.

The plant of the Rockford Cedar Chest Co., Rockford, Ill., was destroyed by fire, Feb. 1, with a loss of $74,000. Insurance on building, $6500.

The plant of the Waldron Gasoline Co., near Evans City, Penn., was wrecked by an explosion, Jan. 30, and damaged to the extent of $2000.

The Insley Manufacturing Co., industrial engineers, Indianapolis, Ind., will build an addition to its plant, at Frank St. and Belt railroad.

The Egyptian Products Co., Wellsville, Ohio, incorporated to equip plant to make line of pottery ware. John Davis, W. E. Smith and others.

The Cleveland Metal Products Co., of Cleveland, Ohio, manufacturers of auto parts, will erect additions to their plant. F. W. Ramsey is president.

The plant of the Jamestown Shale Paving Brick Co., Jamestown, N. Y., was badly damaged by fire. The loss is $25,000. The company will rebuild.

Electric-light plants will be installed on two steamers to be built for the Pittsburg Steamship Co., by the American Shipbuilding Co., Cleveland, Ohio.

The Goodyear Tire & Rubber Co., Akron, Ohio, will add 2000 hp. to its power plant. Plans are being prepared for a 9000 hp. steam-power plant.

The Monroe Canning & Preserving Co., Monroe, Ohio, just organized, with $25,000 capital, will buy machinery for canning factory. T. Bretney is manager.

The main generating plant of the Philadelphia Electric Co., Twenty-eighth and Christian Sts., Philadelphia, Penn., was damaged by fire, Jan. 31. Loss, $1000.

Plans and specifications have been completed for a large new boiler house and power plant to be built for the Reading Brewing Co., at Reading, Penn.

The Trenkamp Stove Co., Cleveland, Ohio, makers of gas and gasoline stoves, have doubled their capital and will buy new grist mill. J. Nornung is manager.

The grain elevator of the Northern Malting Co., North Ashland Ave. and Bloomingdale Road, Chicago, Ill., was destroyed by fire, Feb. 5. Loss, $500,000.

The Guenther Silk Hose Co., Dover, N. J., is planning the construction of a new factory, 50x200 ft. Machinery has been ordered and construction will soon begin.

A grain elevator in the rear of 231 East One Hundred and Twenty-ninth St., New York, owned by William H. Payne & Son, was burned, Feb. 6, at a loss of $50,000.

Fire completely destroyed the six-kiln evaporator plant of Hosenfeldt & Smith, at Hatch St. and State Road, Webster, N. Y., on Jan. 26. Loss, $6000, partly covered by insurance.

The Winton Gas Engine & Manufacturing Co., Cleveland, Ohio, who will make a new gas engine, will erect a new factory 80x300 ft., and fully equip it with machine tools.

W. L. Higgins, 935 North Meridian St., Indianapolis, Ind., has taken out a permit to erect a factory in West Washington St., presumably for the manufacture of window screens.

The stock, machinery and fixtures of the Excelsior Woodworking Co., Jacob Schlesinger, proprietor, at 222 East Thirty-seventh St., New York, was damaged by fire, Jan. 26. The insurance is $10,000.

The Augustine Rotary Power Co., Columbus, Ohio, just incorporated for $500,000, by B. F. Augustine, J. L. Moore and D. B. Grubbs. Will buy considerable machinery and tool equipment for a new factory.

The Automatic Fire Sprinkling Co. of America, now located at Akron, Ohio, will move the entire plant to Youngstown, Ohio. New power and electrical plants, together with new machine tools, will be purchased.

The Cairo Electric Traction Co., Cairo, Ill., expects to construct an addition to its power house, 60x80 ft., and install additional generators which will double the output of the plant. The cost of the work is estimated at $60,000, and W. A. Cavender, Cairo, Ill., is chief engineer.

A site has been acquired by the Mitchell-Conner Manufacturing Co., at Reading Road and Dorchester Ave., Cincinnati, Ohio, on which a large factory will be erected at once. This is a new company and will make reversible window frames and other hardware specialties. A. R. Mitchell is secretary.

SOUTHERN STATES

The Union Box Co. will build a new factory, at Lancaster and Durham St., Baltimore, Md.

The Baltimore Refrigerating & Heating Co., Baltimore, Md., is building an addition to its plant.

The City Council of Cumberland, Md., has voted to install an electric-light plant. George S. Young, mayor.

Macon Ga., will erect a new pumping station for its water system. W. H. Fetner, chairman of Water Commissioners.

An electric-power plant and machine shop will be installed in the new four-story warehouse of Oliver, Reeder & Sons, Baltimore, Md.

The bar fixtures and furniture plant of F. X. Ganter & Co., Leadenhall and Stockholm St., Baltimore, Md., will be enlarged extensively.

The planing mill, furniture, dry kilns and two box cars owned by the Wood Manufacturing Co., Waynesville, N. C., were destroyed by fire, Jan. 30. Loss, $20,000.

The syrup mill owned by John J. Lebrassier, of the Seventh Ward, St. Francisville, La., was totally destroyed by fire, Jan. 26. Loss, $8000. There was no insurance.

The Asheville Cotton Mills, Asheville, N. C., will expend $50,000 for improvements to its plant and for new machinery. The concern manufactures colored cotton goods.

The Horine Development Co., Atlanta, Ga., will erect a plant, at Lafayette, Ga., for the manufacture of cement, with a daily capacity of 2800 bbl. Edward M. Horine is president.

Fire damaged the stave factory of A. S. Dies & Co., on South Seventh St. and the river, Nashville, Tenn., on Jan. 29, and completely destroyed the main shed where machinery for manufacturing hoops and barrel staves was kept.

The factory of the Beck Brush Co., 1034 North Gay St., Baltimore, Md., was damaged by fire to the extent of several thousand dollars. The loss was mostly to the machinery, and an almost entirely new equipment will be purchased.

The Southern Packing & Product Co., Memphis, Tenn., has incorporated, with $50,000 capital, and will establish a packing and canning plant. Incorporators are H. E. Vernon and Fred N. Taylor, of Memphis; T. A. Hall, of Whitehaven, Tenn.

The Louisville & Interurban Ry. Co., Louisville, Ky., will begin work immediately on a new power plant, a site for which has been secured and drawings for which are now being made by D. X. Murphy & Bro., architects. The equipment to be installed consists of two steam turbines, with boilers and auxiliaries.

WEST OF THE MISSISSIPPI

E. W. Branch will erect a canning factory, at Marengo, Iowa.

The Cedar Falls Broom Co. will enlarge its broom factory, at Cedar Falls, Iowa.

The S. & S. Packing Co. has decided to erect a packing plant, at Sioux Falls, S. D.

William Moore will build a modern milling plant, at Mitchell, S. D., this spring.

The Freyder Planing Mills, at Iowa City, Iowa, were recently destroyed by fire. Loss, $20,000.

The East Rickardsville Creamery Co., Durango, Iowa, will build a modern creamery, this spring.

The Wichita Falls Motor Co., Wichita Falls, Tex., is preparing to make extensive additions to its plant here.

The Chinook Creamery, Chinook, Mont., will build an addition to its factory and also establish a cold-storage plant.

It is reported that the Hypo Manufacturing Co., of Fort Wayne, Ind., will establish a plant, at Hutchinson, Kan.

J. B. Salyer and M. L. King will soon begin the work of erecting a cotton gin, at Georgetown, Tex., at a cost of $16,000.

D. J. Doyle, secretary of the Darwin Creamery Association, will build a creamery plant, this spring, at Darwin, Minn.

The H. C. Newell Co., Sioux Falls, S. D., will build a cold-storage plant, of 20 cars' capacity. Machinery will be purchased.

The Quaker Oats Co., Fort Dodge, Iowa, will rebuild their building, recently destroyed by fire. O. C. Kern is chief engineer.

The building and machinery of the Van Tillburg Oil Co., 2424 University

Ave., Minneapolis, Minn., were damaged by fire, Jan. 29. Loss, $1000.

A grain elevator belonging to the Farmers' Co-operative Elevator Co., at Geddes, S. D., was burned, Jan. 29. Loss, $10,000, covered by insurance.

The Rochester & Wyoming Asbestos Co. will erect a 75-ton mill to handle the asbestos rock from their claims, at Glenrock, Wyo. M. Powers is general manager.

The new brick plant of the Seco Pressed Brick Co., D'Hanis, Tex., has just been finished and is now in operation. The plant has a daily capacity of 90,000 bricks.

The El Paso Milling Co., El Paso, Tex., which was recently formed with principal offices at Toronto, Can., has been granted a permit to do business in Texas. This company is erecting a large woodworking mill here and will also establish lumber mills and a paper mill.

PACIFIC COAST

The Washington Union Coal Co. will erect a $250,000 power station at Tom, near Centralia, Wash.

Durley & Herrick, Last Chance, Calif., will erect a planing mill in the near future, at Doyle, Calif.

The Cereal Food Co., Richmond, Calif., whose factory was recently destroyed by fire, will rebuild at once.

E. A. Sims and H. F. Simonds, Juneau, Alaska, plan to build a fish-canning plant, at Hoonah, Alaska.

The city of Antelope, Calif., contemplates the erection of a power plant to furnish power for the city.

The Hermosa Box Co., Hermosa Beach, Calif., are planning to build a new plant. Modern equipment will be installed.

The city of Long Beach, Calif., has taken out a permit to build a public comfort station. Estimated cost, $20,000.

The World Kuppresh Co., manufacturers of preserved fruits, will construct a plant, at Tenth and Washington St., Hillsboro, Ore.

C. H. Cornelius, Fresno, Calif., will soon acquire a site in Modesto, Calif., and will erect a plant for the manufacture of aëroplanes.

The Indian Oil Co., Spokane, Wash., has acquired a site and will soon commence the erection of a distributing plant. Estimated cost, $50,000.

W. J. Doherty and F. G. Munzer, Bakersfield, Calif., have acquired a site on Mount Breckenridge and plan the erection of a plant for the manufacture of boxes.

Ralph Sutherland and associates, Fresno, Calif., have applied to the Chamber of Commerce, Porterville, Calif., for permission to erect a fruit-canning plant, at Porterville.

Seward Dredging Co., Nome, Alaska, will soon commence the erection of a 1000-hp. hydro-electric power plant on the Solomon River. Otto Halla is head of the company.

The Southern Manufacturing Co., San Diego, Calif., is planning to erect a plant for the manufacture of Pullman veneer. M. H. Hart and M. G. Tyler are at the head of the company.

The Los Angeles China Manufacturing Co., Los Angeles, Calif., has acquired a site at Long Beach, and will soon commence the erection of its proposed plant for the manufacture of its specialty. Theodore Dittell is president.

CANADA

Richmond, B. C., will equip a complete new water-works system.

The Salvation Match Co., of Cookshire, Que., will equip a big new factory there.

The Magnet Cream Separator Co., of Hamilton, Ont., will extend its factory.

The Urchel Bates Valve Bag Co. will equip a big new plant, at Niagara Falls, Ont.

The Amherst Central Shoe Co. will locate a new $100,000 plant, at Regina, Sask.

The plant of the Nova Scotia Knitting Mills Co., at Eureka, N. S., will be doubled.

Fire did $85,000 damage to the plant of Shearer, Brown & Wills planing mill, at Montreal.

Winnipeg, Manitoba, is calling for bids up to Mar. 1 for a motor-driven, 5,000,000-gal. pump.

Short & Knapp, Sault Ste. Marie, Mich., will erect a brewery, at Calgary, Alta., to cost $200,000.

Toronto, Ont., will purchase a 15,000,000-gal. water-works pump. F. L. Fellowes is city engineer.

The Royal Arms Laundry, 204 Papineau Ave., Montreal, Que., was damaged by fire, Jan. 29. Loss, $25,000.

The Dominion Dairy & Produce Co., Regina, Sask., has been organized and will erect a creamery, this spring.

The factory of the W. A. Wood Co., of Montreal, manufacturers of time recorders, was badly damaged by fire.

The factory of the Strain Skirt Manufacturing Co., at Montreal, was damaged to the extent of $25,000 by fire.

Hensall, Ont., will equip a complete new water-works pumping plant. John Petty, Reeve, has the matter in hand.

The plant of the Dominion Vinegar Works, Stuart St., Hamilton, Ont., was destroyed by fire at a loss of $20,000.

The North River Electric Co., of St. Andrews East, Que., will purchase a quantity of new electrical equipment.

Bids are being received by the Canadian General Electric Co., Toronto, Ont., for the construction of a lamp factory.

The plant of the Toronto Wood Turning Works, 112 Adelaide St., Toronto, Ont., was damaged by fire, Feb. 5. Loss, $2000.

Brown & McKay Co., have acquired a site, at Coquitlam, B. C., and plan to erect a steel plant. The expenditure will be $100,000.

The Dominion Match Co. Canada, has acquired a site at New Westminister, B. C., and soon will commence the erection of a new plant.

The Woodside plant of the Acadia Sugar Refining Co., Halifax, N. S., was completely destroyed by fire, Feb. 1. Loss, $1,000,000, partly covered by insurance.

Fire, which wrecked the printing and stationery plant of Robert Duncan, at York and James Sts., Hamilton, Ont, caused damage to neighboring property. Total loss, $200,000.

The sash and door factory of the plant of Shearer, Brown & Willis, on canal bank at St. Gabriel locks, Montreal, Que., was damaged by fire, Jan. 29. Loss, $25,000, covered by insurance.

The four-story building at 40 St. George St., Montreal, Que., was damaged by fire to the extent of $25,000. The building was occupied by L. E. Waters & Co., printers, W. A. Wood, manufacturers of time recorders, and two other companies.

NEW INCORPORATIONS

METAL WORKING

The Taylor Motor Co., Lynchburg, Va., has been incorporated, with a capital of $25,000, to erect a machine shop.

The Rayfield Motor Car Co., Christman, Ill., has been incorporated, with a capital of $75,000, to manufacture and deal in automobiles.

The Dowling Engine Co., Biloxi, Miss., has been incorporated, to manufacture engines. The incorporators are W. K. Dukate, I. Heidenheim and Lee Elder.

The Connely-Fairweather Hardware Co., Sussex, N. B., has been incorporated, with a capital of $24,000. The incorporators are J. A. Freeze and J. N. Freeze.

The Alco Automobile Co., St. Louis, Mo., has been incorporated, with a capital of $10,000. The incorporators are B. R. Ford, G. Parsons and C. E. Darrow.

The Nyberg Automobile Co., Chattanooga, Tenn., has been incorporated, with a capital of $150,000, to manufacture automobiles. H. Nyberg is manager.

The Utica Brass & Machine Co. has been formed at Fort Worth, Tex., with a capital of $5000. The incorporators are G. M. Bird, F. L. Lightfoot and R. L. Coy.

The Ohio Seamless Tube Co., Shelby, Ohio, has been incorporated, with a capital of $1500, to manufacture tubing. The incorporators are A. C. Morse and E. W. Wiggins.

The Alexander Machine Co., Dover, Del., has been incorporated, with a capital of $250,000, to manufacture machinery. The incorporators are from Wilmington.

The Harrisburg Machine & Shipyard Co., Harrisburg, Tex., has been formed, with a capital of $10,000. The incorporators are J. W. Leary, C. A. Schooley and L. Johnson.

The F. W. Bussmeyer Gas & Machine Co., St. Louis, Mo., has been incorporated, with a capital of $10,000. The incorporators are F. W. Bussmeyer and W. J. Bussmeyer.

The W. H. Copenhaver Hardware Co., Chilhowie, Va., has been incorporated with a capital of $15,000. The incorporators are W. H. Copenhaver, W. R. Scott and W. T. Smith.

The Winton Gas Engine & Manufacturing Co., Cleveland, Ohio, has been incorporated, with a capital of $200,000. The incorporators are A. Winton, J. Winton and W. S. McKinstry.

The Hammond Brass Works, Hammond, Ind., has been incorporated, with a capital of $35,000, to manufacture brass specialties. The incorporators are C. H. Mayer and J. E. Brennan.

The Maxim Tri-Car Manufacturing Co., Morgantown, W. Va., has been incorporated, with a capital of $50,000. The incorporators are H. R. Warfield, Joe K. Buchanan and J. D. Streator.

The Dewey Garage Co., Chicago, Ill., has been incorporated, with a capital of

$3000, to do a general garage business. The incorporators are C. Mabee, J. A. Martinkus and Thomas Brown.

The Davis Automatic Hydro-Gravity Co., Indianapolis, Ind., has been incorporated, with a capital of $10,000, by H. N. McKee, J. H. Vaught and others, to manufacture hydro-gravity motors.

The Stevens Manufacturing & Supply Co., Chicago, Ill., has been incorporated, with a capital of $10,000, to manufacture machines and machinery. C. E. Shou, 934 Glengyle Pl., Chicago, is interested.

The Buffalo Hardware Co., Buffalo, N. Y., has been incorporated, with a capital of $25,000, to manufacture hardware. The incorporators are E. B. McKenna, W. A. Griffin and H. B. Prentice, Buffalo.

The Little Giant Stove & Novelty Co., Fort Worth, Tex., has incorporated, with a capital of $40,000, to manufacture stoves. The incorporators are Lewis Alverson, J. H. Greer and G. H. Colvin.

Universal Motor Truck Co., St. Louis, Mo., has been incorporated, with a capital of $250,000, to manufacture motor trucks. The incorporators are W. H. Taylor, John Beltram and A. R. Shaffer.

The A. D. Skinnell Co., 123 West Thirtieth St., New York, N. Y., has been incorporated, with a capital of $100,000, to manufacture metal goods. The incorporators are C. J. Aller and J. H. Valentine.

The Superior Register Co., Canisteo, N. Y., has been incorporated, with a capital of $500,000, to manufacture cash registers and parts. The incorporators are J. P. Langs and F. Charmann, Niagara Falls.

The Byesville Motor Co., Byesville, Ohio, has been incorporated, with a capital of $100,000, to manufacture gas engines and machinery. The incorporators are R. E. Hall, C. B. Austin and J. A. Pryor.

The Rene Safety Auto Wheel Co., Chicago, Ill., has been incorporated, with a capital of $50,000, to manufacture automobiles and parts. The incorporators are J. R. Avotte, C. F. McKay and J. E. Avans.

The Eagle Register Co., Chicago, Ill., has been incorporated, with a capital of $75,000, to manufacture automatic registers. The incorporators are H. G. Lund, E. L. Hangerstrand and E. A. Norman, Chicago.

The Hamerly Tool & Machine Co., Wilmington, Del., has been incorporated, with a capital of $500,000. The incorporators are E. C. Boiser, F. B. Hamerly, Buffalo, N. Y., and E. R. Cochran, Jr., Wilmington.

The Keller Auto Co., Hoboken, N. J., has been incorporated, with a capital of $100,000, to manufacture machinery. The incorporators are C. D. Bland, M. W. Gibbs and H. R. Blacknam, of 214 Fifth St., Hoboken.

The Marine Hardware Manufacturing Co., Grasmere, S. I., N. Y., has been incorporated, to manufacture hardware and marine supplies. C. D. Durkee is president and E. B. Dennis, superintendent, Grasmere.

The National Rolling Mill Co., New York, N. Y., has been incorporated, with a capital of $250,000, to manufacture and deal in iron. The incorporators are N. B. Kates, L. S. Bachrach, 35 Nassau St., N. Y., and J. C. Brown.

The American Poured Concrete Steel Moulds Co., Dover, Del., has been incorporated, with a capital of $50,000, to manufacture kindred tools and molds. The incorporators are J. P. Jackson, R. T. Harlan and H. A. Hood.

The Safford Illuminated Auto Lamp & Number Co., Dallas, Tex., has been incorporated, with a capital of $25,000, to manufacture automobile supplies. The incorporators are M. M. Parks, F. W. Schaub and F. Greenwood.

The Checkogram Co., New York, N. Y., has been incorporated, with a capital of $175,000, to manufacture a machine known as the checkogram. The incorporators are L. Robinson, J. Alexander and A. A. Smith, New York.

The Syracuse Auto Supply Co., Syracuse, N. Y., has been incorporated, with a capital of $25,000, to manufacture motors and motor vehicles. The incorporators are B. R. Newhall, C. A. Benjamin and M. C. Klock, Syracuse.

The Union Boiler Works Co., Toledo, Ohio, has been incorporated, with a capital of $100,000, to manufacture and repair boilers and machinery. J. Mason Youngs, Edward Radbone and J. Allen Coby are among the incorporators.

The Forsyth Metal Co., Buffalo, N. Y., has been incorporated, with a capital of $30,000, to manufacture metal goods and tools. The incorporators are J. H. Price, 112 Johnson Pk., and H. B. Rose, 413 Massachusetts Ave., Buffalo, N. Y.

The Improved Schifflin Machine Co., New York, N. Y., has been incorporated, with a capital of $25,000, to manufacture machinery. The incorporators are A. Keller, New York; E. Bergen, Brooklyn, and H. A. Salomon, New York.

The Whiffletree Attachment Co., Tyler, Tex., has been formed, with a capital of $10,000, its purpose being to manufacture attachments for whiffletrees. The incorporators are W. P. Bradshaw, T. M. Bradshaw and Sam T. Morris.

The International Automatic Machine Co., New York, N. Y., has been incorporated, with a capital of $100,000, to manufacture automatic vending machines. The incorporators are A. R. Crossman, C. S. Muir and M. M. Lisse, New York.

The Unit Weighing & Packing Co., Baltimore, Md., has been incorporated, with a capital of $750,000, to manufacture and sell machines to weigh, pack and can. The incorporators are L. M. Keizer, J. H. Windfelder and E. P. Hill.

The International Automatic Telephone Co., Springfield, Ohio, has been incorporated, with a capital of $3000, to manufacture telephone machinery. The incorporators are W. H. Brure, F. O. Cummings, H. C. Brure and P. C. Martin.

The Tarrent Manufacturing Co., Saratoga, N. Y., has been incorporated, with a capital of $25,000, to manufacture machinery and tools. The incorporators are W. P. Tarrent, W. R. Wilson, W. P. Buttler and C. B. Kilmer, all of Saratoga.

The Augustine Rotary Power Co., Columbus, Ohio, has been incorporated, with a capital of $500,000, to manufacture combustion engines and machinery. The incorporators are B. F. Augustine, J. L. Moore, J. I. McCullough and A. E. Cather.

The Reheated Air Co., Dover, Del., has been incorporated, with a capital of $200,000, to manufacture hardware, stoves, heaters and machinery. The incorporators are W. F. Michel, Philadelphia, S. H. Tacy, Elkins Park, Penn., and J. G. Gray, Wilmington.

The Franklin Motor Car Co., New York, has been incorporated, with a capital of $100,000, to manufacture motor vehicles. The incorporators are G. A. Tisdale, A. F. Avid, 264 West Seventy-eighth St., New York City, and M. E. McDonald, 2 Sedgwick Ave., Yonkers.

The Apperson Motor Car Co., New York, N. Y., has been incorporated, with a capital of $100,000, to manufacture machinery and motor engines. The incorporators are H. Cannon, 54 West Fifty-fourth St., New York, and F. A. Grasmack, 34 Convent Ave., New York.

GENERAL MANUFACTURING

The Automatic Fire Extinguisher Co., Atlanta, Ga., has been incorporated with a capital of $100,000 to manufacture fire extinguishers.

The Monarch Musical Instrument Co., Tonawanda, N. Y., has been incorporated and will establish a plant to manufacture automatic playing pianos.

The Empire Bottling & Manufacturing Co., Greenville, Texas, has been incorporated. The incorporators are C. L. Bell, W. M. Laird and F. M. Davis.

The Salvation Match Co., Roanoke, Va., has been incorporated with a capital of $50,000. The incorporators are W. B. Hutchinson and W. L. Tucker.

The Eyer Lumber Co., Toronto, Can., has been incorporated with a capital of $200,000. The incorporators are J. H. Eyer, J. H. Creery and A. W. Eyer.

The Canebrake Cotton Mills, Uniontown, Ala., has been incorporated with a capital of $80,000. The incorporators are W. H. Taylor and G. B. Johnston.

A. E. Smith Manufacturing Co., Charlotte, N. C., has been incorporated with a capital of $300,000 to build and operate a cotton mill. A. E. Smith is interested.

The Cotulla Ice & Power Co., Cotulla, Texas, has been formed with a capital of $7000. The incorporators are W. G. Roloff, Richard Wolfsky and Yale Hicks.

The Willimansett Ice Co., Holyoke, Mass., has been incorporated with a capital of $50,000 to manufacture ice. The incorporators are F. J. Clontier and G. C. Robert.

The Milwaukee Milling Machine Co., West Allis, Wis., has been incorporated, with a capital of $5000. The incorporators are E. J. Kearney, T. Tucker and M. Wells.

The Painton Brick Co., Troy, N. Y., has been incorporated with a capital of $30,000 to manufacture bricks, cement and building material. The incorporator is J. J. Painton.

The Humboldt Canning Co., Los Angeles, Calif., has been incorporated, with a capital stock of $80,000. The incorporators are B. L. Hogan, G. R. Field, and C. F. Holland.

The Cement Product Co., Quebec, Canada, has been incorporated with a capital of $1,000,000. The incorporators are G. P. Eisenschim, Vienna, Austria, and E. Slade, Quebec.

The Bladenboro Cotton Mills Co., Bladenboro, N. C., has incorporated, with a capital of $300,000, to manufacture cot-

ton goods. H. C. Bridgers is at the head of the new company.

The Grindrod-Hickey Manufacturing Co., Los Angeles, Calif., has been incorporated, with a capital of $300,000. The incorporators are J. Grindrod, O. S. Hickey and R. D. Heddens.

The Universal Hanger Co., Oak Park, Ill., has been incorporated with a capital of $10,000. The incorporators are H. A. Cotton, T. F. Hanson, M. G. Cotton and M. E. Hanson.

The Western Spinning Co., Duluth, Minn., has been incorporated with a capital of $25,000 to operate a spinning mill. The incorporators are J. H. Barnes, W. Ames and E. H. Smith.

The Portland Cement Product Co., Lasalle, Ill., has been incorporated, with a capital of $6000, to manufacture cement. The incorporators are E. Goodman, G. A. Wilson and A. E. Preuss.

The Groat Furniture Co., Philadelphia, N. Y., has been incorporated with a capital of $20,000 to manufacture and deal in furniture. The incorporators are E. C. Groat and H. Groat.

The Carbondale Absorption Ice Machine Co., Montreal, Can., has been incorporated with a capital of $50,000. The incorporators are J. W. Cook, A. A. McGee and O. B. MacCullum.

The Exchange Ice Co., Los Angeles, Calif., has been incorporated with a capital of $25,000 to erect and operate an ice plant. The incorporators are J. F. Paulding and J. W. Dunlop.

The Gray Manufacturing Co., Buffalo, N. Y., has been incorporated with a capital of $30,000 to manufacture machinery. The incorporators are T. Gray, B. B. Pannet and C. Randall.

Pullman-Tucker Co., Parkersburg, W. Va., has incorporated, with a capital of $25,000, to manufacture candy. Incorporators are Robert C. Tucker, B. F. Pullman and Mary F. Tucker.

The Mutual Manufacturing Ice Co., Chicago, Ill., has been incorporated with a capital of $150,000 to manufacture ice. The incorporators are W. Derzbach, E. K. Hand and J. R. Mahony.

The J. F. Loving Furniture Co., Morgantown, W. Va., has been incorporated with a capital of $25,000 to manufacture furniture. The incorporators are S. P. Jones, J. F. Loving and J. L. Hatfield.

The Burns Jewelry Manufacturing Co., Boston, Mass., has been incorporated with a capital of $250,000 to manufacture jewelry. The incorporators are G. F. Burns, C. A. Gridley and B. F. Frost.

The Firestone Tire & Rubber Co., Dallas, Texas, has been incorporated with a capital of $10,000 to manufacture tires and rubber. The incorporators are P. B. Talbott, E. D. Manley and J. T. Stuart.

The Michel Stairs Co., Chicago, Ill., has been incorporated, with a capital of $2500, to manufacture wooden cabinets and fixtures. The incorporators are F. H. Michel, E. G. Kusswurm and E. Harpole.

The Lumberville & Steel Co., Lumberville, Penn., has been incorporated, with a capital of $20,000, to manufacture machinery. The incorporators are J. W. Arnett and W. F. Bayhurst, Lumberville, Penn.

The School Furniture Co., Rockford, Ill., has been incorporated, with a capital of $25,000, to manufacture school furniture. The incorporators are John W. Eskholme, Josephine Martin, Wallace E. Shirra.

The Standard Non-Refillable Bottle Co., Buffalo, N. Y., has been incorporated with a capital of $200,000 to manufacture bottles and jars. The incorporators are A. F. Bigger, F. Whitacre and J. O. Chapin.

The Starn Manufacturing Co., Camden, N. J., has been incorporated with a capital of $500,000 to manufacture automobile tires. The incorporators are G. E. Starn, G. M. Cline and W. C. Wayne, Camden.

The Norman Lumber & Box Co., Louisville, Ky., has been incorporated with a capital of $175,000 to manufacture boxes. The incorporators are A. E. Norman, E. B. Norman, R. Carnhan and A. B. Thurman.

The Lande Window Co., Brooklyn, N. Y., has been incorporated, with a capital of $50,000, to manufacture doors and trim hardware. The incorporators are M. Lande, Brooklyn, and H. Ettenson, New York City.

The Enterprise Garnetting Co., New York, has been incorporated with a capital of $75,000 to manufacture cotton and wool waste. The incorporators are F. B. Graves and G. C. Angus, 401 Madison Ave., Albany.

The Sanitary Garbage Vehicle Co., Los Angeles, Calif., has been incorporated with a capital of $75,000 to manufacture a new garbage vehicle. The incorporators are A. G. Sharp, D. E. Luther and F. A. Cardwell.

The General Lighting Fixture Co., Chicago, Ill., has been incorporated, with a capital of $3000, to manufacture gas and electric-lighting fixtures. The incorporators are J. N. Rosenfield, E. Wangersham and S. Stein.

The Conrad Brick Co., Columbus, Ohio, has been incorporated with a capital of $40,000 to manufacture brick. The incorporators are W. D. Brickell, David Shertzer, John A. Conrad, J. M. Adams and David Lehman.

The Ozoma Manufacturing Co., New York, N. Y., has been incorporated, with a capital of $100,000, to manufacture sugar and molasses. The incorporators are E. D. Buel, F. A. Schrader and W. F. Connolly, New York.

The Cohen Typermass Co., New York, N. Y., has been incorporated with a capital of $25,000 to manufacture paper boxes. The incorporators are B. Cohen, 327 Stone Ave., and M. L. Typermass, 468 Jerome St., Brooklyn, N. Y.

The Lisbon Falls Manufacturing Co., Lisbon Falls, Maine, has been incorporated, with a capital of $10,000, to manufacture articles of wood and metal. W. H. Newell Lewiston, president, and H. E. Plummer, Lisbon Falls, treasurer.

The Portland Card Match Co., Portland, Maine, has been incorporated, with a capital of $30,000, to manufacture matches and machines. W. M. Greene, president, Portland, F. W. Hinckley and E. Marshall, South Portland, Maine.

The Brooklyn Paper Box Co., Brooklyn, N. Y., has been incorporated, with a capital of $10,000, to manufacture paper boxes. The incorporators are G. Davis, 501 Ave. C, S. Albert, 155 Vernon Ave., and S. Blank, 66 Lewis Ave., Brooklyn.

The Canton Broom & Brush Co., Canton, Ohio, has been incorporated with a capital of $100,000 to manufacture brooms and brushes. The incorporators are W. H. Pennock, W. H. Longabaugh, W. C. Elliott, E. B. Hanson and J. H. Wilson.

The American Textile Manufacturing Co., Cleveland, Ohio, has been incorporated with a capital of $10,000 to manufacture textiles. The incorporators are Charles W. Aeltzer, Carl R. Brown, John B. Oviatt, Charles B. Bagley and Lena A. Gregg.

The Terpezone Co., New York, N. Y., hs been incorporated with a capital of $100,000 to manufacture medical appliance machines. The incorporators are F. H. Travis, 203 Broadway; H. Fletcher and R. S. Fletcher, of 165 Broadway, New York.

The Egyptian Products Co., Wellsville, Columbiana County, Ohio, has been incorporated with a capital of $20,000 to manufacture and deal in roofing. The incorporators are John Davis, T. T. Snowden, W. E. Smith, D. H. Kissel and E. H. Cree.

The Moorestown Ice Co., Moorestown, N. J., has been incorporated, with a capital of $30,000, to manufacture ice. The incorporators are A. B. Jenks, Anglesea, P. C. Barr, 506 Cinnaminson St., Riverton, N. J., and S. G. Hatcher, Fairview Riverside, N. J.

The Matherville Light & Power Co., Matherville, Ill., has been incorporated, with a capital of $10,000, to build and conduct general electric-light, heat and power business by Paul Wagner, J. W. Walsh, John J. Ryan, H. C. Lightner, W. W. McCullough.

The Braender Rubber & Tire Co., Wallington, N. J., has been incorporated, with a capital of $250,000, to manufacture rubber goods and tires. The incorporators are P. Braender, H. Braender, White Plains, N. Y., and F. L. Braender, Passaic, N. J.

The National Binding Machine Co., New York, N. Y., has been incorporated, with a capital of $150,000, to manufacture all kinds of paper. The incorporators are J. D. McLaurin, Orange, N. J., R. O'Neil, Jersey City, N. J., and S. B. Emmert, New York.

The Advance Rubber Co., Brooklyn, N. Y., has been incorporated with a capital of $150,000 to manufacture automobile tires and rubber goods. The incorporators are G. F. Allison, 115 Broadway, and C. Pinney, 30 West Forty-fourth St., New York.

The Progressive Typewriter Co., New York, N. Y., has been incorporated, with a capital of $20,000, to manufacture typewriters. The incorporators are C. J. McLean, 132 Nassau St., G. C. Irvin, 116 Nassau St., and W. P. Weidman, 132 Nassau St., New York City.

The Paradise Paper Box Co., New York, has been incorporated with a capital of $10,000 to manufacture paper boxes. The incorporators are H. Paradise, 599 Bargy St., Brooklyn, N. Y., and H. Angel, 9 West One Hundred and Fourteenth St., New York.

The Pittsburg Reflector & Illumination Co., Camden, N. J., has been incorporated with a capital of $50,000 to manufacture glassware and window glass. The incorporators are V. A. Murray, L. A. Meyer and M. L. Brennan, Mason Building, 50 Cary St., Orange.

The Shartle Continuous Beater Co., Middletown, Ohio, has been incorporated with a capital of $50,000 to manufacture paper and paper-making machinery. The incorporators are Charles W. Shartle, Lucy C. Shartle, H. D. Martindale, G. Kaffenberger, W. T. Harrison.

FORTHCOMING MEETINGS

American Society of Engineer Draftsmen. Regular Meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Hotel Bellevue. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month, Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

American Boiler Manufacturers' Association, in conjunction with Supplymen's Association. Twenty-fourth annual convention, New Orleans, La., Mar. 12-15. J. D. Farasey, secretary, East Thirty-seventh St. and Erie R.R., Cleveland, Ohio.

American Society for Testing Materials. Annual meeting, New York City, Mar. 28-29. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Master Boiler Makers' Association. Sixth annual convention, Fort Pitt Hotel, Pittsburg, Penn., May 14-17. J. Rogers Flannery, secretary arrangements committee, Flannery Bolt Co., Pittsburg, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

MEN WANTED

Canada

STORES-MAN, thorough, uptodate, energetic stores-man; one who has had a large experience in looking after materials, rather than ordering of materials; one familiar with perpetual or latest inventory systems; electrical trade preferred; good salary paid to competent man. Reply, with references, to Canadian General Electric Co., Peterboro, Ont.

California

A THOROUGHLY competent, middle-aged man, experienced in handling from 100 to 200 men, for a shop close to Los Angeles, Calif., and manufacturing riveted steel pipe, and doing a general light and heavy plate and tank business; must be thoroughly conversant with modern shop methods, a master of handling men and obtaining a maximum of production at a minimum of cost; a steady position with advancement for the right man; state age, experience, references and salary expected. Address "Manufacturer," Box 965, Am. Machinist.

Connecticut

HARDENER—A thoroughly practical hardener, one experienced in heat treating, hardening and tempering carbon and alloy steels, and capable of taking full charge of such work; only a man of good habits will be considered, and he must be one who is still able to learn. Address with full particulars as to experience, salary expected, etc., to "Steel Hardener," Am. Machinist.

MODEL MAKER—First-class on instrument work, such as taximeters, speedometers, carburetors, odometers, counters, etc.; a man with ability to carry out inventor's ideas. One with technical training preferred; must have phlegmatic disposition and not be easily discouraged; must be just as ambitious to succeed while working out another's ideas as his own, even though he considers his own better, and yet may feel free to make any suggestions that will in his mind be desirable. Box 929, Am. Machinist.

Illinois

SALESMEN—Opportunity for young technical graduates of pleasing personality and commercial instincts to develop into salesmen for large concern; shop experience in heat treatment and use of tool steel valuable, though not essential; those giving most information will receive greatest consideration. Box 949, Am. Machinist.

PRODUCTION ENGINEER—A large manufacturing company, located in the suburbs of Chicago, and making high-grade mechanical tools operated by gasoline and compressed air, wishes to employ a high-grade production engineer, who has had at least five years' experience; must be familiar with every detail of planning and laying out thousands of small parts and putting them through the plant economically and systematically. Box 961, Am. Machinist.

SALESMAN—Bright young man with machine-shop or tool-room experience as tool-steel salesman; should have business point of view, good presence, and be willing to start at a nominal salary; give age, experience, record and references, first letter. Box 950, Am. Machinist.

Indiana

TOOL GRINDER—Experienced Gisholt universal. Address M. Rumely Co., LaPorte, Ind.

Maryland

SPOON MAKER—Must be experienced and familiar with uptodate methods of making retinned steel spoons, knives and forks; good opportunity for right man; give references. Address "Expert," Am. Machinist.

Massachusetts

INSPECTOR on gear jobbing work; state age, experience and wages expected. Boston Gear Works, Norfolk Downs, Mass.

TOOL MAKER, all-round, in gear-jobbing shop; experienced on gear cutters, hobs and general tools; state age, experience and wages expected. Box 930, Am. Machinist.

JOBBING GEAR SHOP—Young man, experienced in gear jobbing work, to assist in estimating department and laying out work for the shop; state age, experience and wages expected. Boston Gear Works, Norfolk Downs, Mass.

SUPERINTENDENT to take charge of plant manufacturing small tools, such as cutters and drills; good opening for a man of experience and executive ability; liberal salary. Box 870, Am. Machinist.

Michigan

DRAFTSMAN—One who has had experience in mixing and agitating machines, also conveying and flour mill machinery; state experience and wages expected. Box 861, Am. Machinist.

A LARGE manufacturing concern offers exceptional opportunity and chance for advancement to young men who are good mechanics as workmen; if you are thoroughly experienced, ambitious, a hustler, of good character, and have ability to direct others to increased efficiency, address Box 896, Am. Machinist.

Minnesota

DESIGNER and draftsman who is thoroughly familiar with the design and manufacture of folding film cameras; write in confidence, giving full particulars as to experience, age and salary expected. Box 831, Am. Machinist.

MASTER MECHANIC for agricultural-implement plant; one who thoroughly understands the designing of tools, jigs, dies, templets, etc., especially making dies for pressed-steel work; we have a very good opening for the right man; state experience in full. Box 970, Am. Machinist.

Missouri

DESIGNER—Experienced jig and tool designer; one who has had experience on small rapid working jigs and tools; state age and references as to where you have produced results. Address Superintendent, Century Electric Co., St. Louis, Mo.

CHIEF DRAFTSMAN for St. Louis concern manufacturing an established line of pneumatic and sawmill machinery; steady position over room with six to ten men; man must be a very competent, practical machine designer and systematic drawing-room executive; no amateur considered. Apply Room 530, No. 30 Church St., New York, or Curtis & Co. Manufacturing Co., St. Louis, Mo.

New Jersey

FACTORY SUPERINTENDENT, familiar with interchangeable production of high-grade parts; state age, experience and salary expected. Box 934, Am. Machinist.

SUPERINTENDENT, to take charge of plant; preferably a man accustomed to the manufacture of wood-working machinery; employ about 200 men; state age, experience, etc. H. B. Smith Machine Co., Smithville, N. J.

New York

SALESMAN on commission basis, in Pacific Coast States to represent die-casting manufacturer; reference required. Box 921, Am. Machinist.

DESIGNERS, uptodate, on punch-press tools for small interchangeable parts; state age, experience, nationality and salary expected. Address "Interchangeable," Box 951 Am. Machinist.

FIRST-CLASS horizontal boring-machine and planer hands; permanent position and good opportunity for advancement, if competent; state experience and wages expected. Box 924, Am. Machinist.

MECHANICAL DRAFTSMAN for general and detail work; man experienced on valves or hydraulic lines preferred; state age, married or single, experience, if now employed or where last employed; salary expected to start with; good opportunity for right man. Box 931, Am. Machinist.

FOREMAN DIE MAKER—A first-class man having had experience in making dies for finished white-metal castings; capable of estimating costs and energetic enough to see that these estimates are met; answers treated confidentially; give experience and age; the latter is no barrier. Box 964, Am. Machinist.

FOREMAN for press department employing 20 operators; must be experienced in handling help and all perforating, blanking and drawing dies using the various gages of metals, and competent of producing a volume of work. Address, stating experience, references, age and salary expected, Box 953, Am. Machinist.

DESIGNER—We require the services of an experienced designer of heavy machinery who has demonstrated his ability and can show actual results; he must be a man who designs with a view to the most simple methods of construction; the right salary to the right man; if you can fill the bill, write, otherwise save your time and ours; correspondence confidential. Box 960, Am. Machinist.

Ohio

DESIGNER—A first-class printing-press designer; a responsible and well established company, who are developing a rotary press, wants to secure a press designer who has had a broad experience in this line; the right man can command a good salary and secure a stock interest in the company; all correspondence strictly confidential. Address "Rotary Press Builder," Box 867, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling ma-

chine operators, wood and metal pattern-makers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

OPERATOR for Jones & Lamson 2x24 flat turret lathe. Address A. H. Fox Gun Co., Philadelphia, Penn.

TOOL MAKERS—Several first-class tool makers, experienced on small, accurate die work; state experience and salary wanted. Box 811, Am. Machinist.

TOOL MAKER—Experienced on small electrical work, incandescent-lamp sockets, snap switches, etc. Address in confidence, giving full particulars, Wirt Electric Specialty Co., Germantown, Phila.

THREE YOUNG MEN to take charge of the following departments: Japanning room, drill presses, sensitive drills, and punch presses; only those need apply who have experience in small interchangeable work similar to typewriter, adding machines and fire-arms; must be able to handle help and give first-class references; strictly temperate and steady; state briefly your experience and wages; factory in the region of Pittsburg. Box 966, Am. Machinist.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and compocing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Wisconsin

MECHANICAL DRAFTSMAN, experienced in industrial-plant engineering; master mechanic or machinist for upkeep and repair. Address J. S. Eckert, superintendent, Rock County Sugar Co., Janesville, Wis.

FOREMAN for machine shop employing about 50 men; must be up to date in modern methods of manufacturing small interchangeable parts, and a good executive; give previous experience, age and salary expected; state full particulars in first letter or no attention paid. "X Y Z," Am. Machinist.

Positions Wanted

Connecticut

TECHNICAL MECHANIC, graduated, 10 years' experience tool and die maker, tool and machine designer, able to handle men, wishes to change. Box 925, Am. Machinist.

A YOUNG MAN, experienced in shop, office and drawing room, on tool design, interchangeable manufacture and general drafting wants responsible position with prosperous and growing concern; executive ability. Box 956, Am. Machinist.

FOREMAN—Tool-room foreman, or other responsible position; broad experience with leading corporations, on equipment, manufacturing and system, for varied lines of small and medium size product; ambitious and thorough mechanic. Box 969, Am. Machinist.

Massachusetts

FOREMAN of machine shop; 18 years' practical experience; best of references; American, 39 years old; free to take position Apr. 1. Box 927, Am. Machinist.

Michigan

FOREMAN — Gear-cutting foreman wants position where high-class work is required; know the business and can produce the goods; automobile shop preferred. Box 968, Am. Machinist.

New Jersey

MECHANICAL DRAFTSMAN, with three years' experience on engine work; good man. Box 967, Am. Machinist.

FOREMAN—Has had 10 years' experience handling men, uptodate shops; progressive; good organizer of shop force. Box 937, Am. Machinist.

DRAFTSMAN, experienced in checking machine shop, tool room, instrument and vacuum-cleaner work; also interchangeable tools. Box 973, Am. Mach.

MECHANICAL ENGINEER, technical graduate, seven years' experience, boiler, gas engine and steam turbine testing as regards efficiency, power-plant operation, design and construction, desires position with consulting or contracting firm, or as executive engineer in manufacturing concern. Box 954, Am. Machinist.

TOOL MAKER—Technically educated uptodate mechanic, 32, tool maker and designer; 12 years' practical experience in modern manufacture of intricate machinery, such as type-setting machines, typewriters, watches; good handler of help; to prove ability will start at low salary; A1 references. Box 958, Am. Machinist.

New York

MECHANICAL DRAFTSMAN wishes position. Box 940, Am. Machinist.

DESIGNER, experienced in designing special and automatic machinery, wants position. Box 483, Am. Machinist.

METAL PATTERN MAKER, first-class, all-around, desires a steady position in New York City or around New York. Box 957, Am. Machinist.

MACHINIST — Expert tool maker, superintendent, manager, strong executive, will accept less responsible position than ability warrants to make good connection. Box 944, Am. Machinist.

SUPERINTENDENT or assistant desires change; nearly 10 years in my present position; I am well under 40, a thorough mechanic with technical education, experienced in managing large numbers of mechanics in the manufacture of both large and small interchangeable parts and have held executive positions for the past 12 years. Box 941, Am. Machinist.

Ohio

FOREMAN, die maker or superintendent; a thorough expert on all classes of work; good executive; the finest of references. Box 952, Am. Machinist.

SHOP SPECIALIST—Can reduce the cost of production, give the best methods of acquiring the cost, and provide an absolute safeguard against any form of labor trouble. Address "No. 1 Shop Specialist," Am. Machinist.

Pennsylvania

MANAGER—By technical graduate; twelve years' experience; steel foundry and general machinery business. Box 912, Am. Machinist.

DRAFTSMAN and designer, experienced in blowing engine, boiler, pump and condenser work, desires position in or near Philadelphia. Box 962, Am. Machinist.

DESIGNER, age 34, with shop experience, open for engagement; experienced on adding machines and special automatic machinery; prefer adding or similar machines. Box 971, Am. Machinist.

SUPERINTENDENT or works manager; experience typewriters, adding machines, cash registers; aggressive; first-class references; age 36; married; will be open for engagement about Mar. 15. Address Box 959, Am. Machinist.

Virginia

MECHANICAL ENGINEER, technical graduate; 12 years' experience in design and construction of heavy machinery, centrifugal sand and dredging pumps, hydraulic dredges and dipper dredges, mining machinery, etc.; at present chief engineer for well known Eastern pump manufacturer, desires change, either as assistant general manager, assistant chief engineer in larger concern or chief engineer in smaller concern; good systematizer; fully acquainted with correspondence, selling and buying; hustler with good commercial training and good executive ability; age 29; married. Box 943, Am. Machinist.

Wisconsin

MACHINE SHOP FOREMAN, 15 years' experience, desires position immediately. Box 975, Am. Machinist.

GENERAL FOREMAN or factory superintendent, experienced on steam and gas engines, heavy and medium mill machinery and pneumatic tools; open for engagement at once; best of references. Box 974, Am. Machinist.

Miscellaneous

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Portable shafting straighteners; prices reduced. J. H. Wells, Glendale, Calif.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Technical Patents. G. M. Sacerdote, M. E. and P. A., 1919 Broadway, New York.

Broken machinery welded and guaranteed. Waterbury Welding Co., East Waterbury, Conn.

Removal—On Mar. 1 will remove to larger quarters—No. 38 Vesey St., New York. Frevert Machinery Co.

For Rent—Private office with use of telephone, stenographers and other facilities. Hudson Terminal Building. Box 963, Am. Machinist.

High-grade machine work in quantities for gear cutters, hand turrets, milling machines, etc., wanted. The Seneca Falls Mfg. Co., Seneca Falls, N. Y

For Sale—Small machine shop in a first-class city in western Washington; grand opportunity for marine and gasoline work. Box 972, Am. Machinist.

Tool tempering chart, 13½x1½ inches, printed in colors with full description; 10 cents postpaid. Spon & Chamberlain, 123 Liberty St., New York, publishers.

For Sale—In Southern state; all or part interest in small machine shop and brass foundry; original investment $5000; owner desires to retire. Box 976, Am. Machinist.

Special machinery. We have the best facilities for building to order medium weight, high-grade machinery. Thirty minutes from Broadway. The Binsse Machine Co., Harrison, N. J.

For Sale—Eight-in. Rivett b-g Precision lathe and many attachments; No. 3 Greenard arbor press; two wheel emery grinder and three-in. Emmert vise; tools new, price right. "J. J.," Am. Ma.

For Sale — Bargain, machine shop, small metal work; complete nickel-plating plant and equipment for cabinet work; 12,000 sq.ft. in operation. Machine Co., 1131 South Broadway, St. Louis, Mo.

For Sale—Powell planer in first-class condition, 96x96 in.x16 ft. bed; bed 8 in. thick; four heads, two on the rail, two on the side; weight, 120,000 lb.; price f.o.b. Fort Wayne, Ind., $5500. Box 948, Am. Machinist.

For Sale—One No. 14 Morgan nailing machine in first-class condition, with direct-connected 60-cycle, 220-volt motor; further particulars may be had on application to Cluett, Peabody & Co., engineering department, Troy, N. Y.

A real live firm of engineering contractors, doing fine business with consulting engineers, industrial concerns and the building trade throughout England, are prepared to represent an American house of good financial standing. Reply Box No. 1173, care of C. Mitchell & Co., Ltd., 1 and 2 Snow Hill, London, E. C.

German, French and Great Britain manufacturing rights for sale on three valuable inventions, consisting of an attachment for utilizing furnace gases to heat feed water; speed-changing mechanism of new design, and an improved suction pump for heating, ventilating, refrigerating, etc.; fully protected by patents; complete information given upon request. Box 955, Am. Machinist.

Receiver's sale of machine shop, completely equipped for light manufacturing, models, or job work; known as F. G. Johnson Co.; located 172 Pearl St., Hartford, Conn.; established 12 years. Sealed bids for entire plant received until noon, Feb. 29, receiver reserving right to reject any bids. Unusual opportunity to buy old-established business at receiver's sale. For inspection or list of equipment address Fred H. Fuller, receiver, 172 Pearl St., Hartford, Conn.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

Talks With Our Readers

By The Sales Manager

George Westinghouse, inventor of the air-brake, which practically revolutionized railroading, has told how he came to discover and perfect it.

It is a vivid picture for the man who says, "I've no time to read technical papers." It's a lesson which teaches that value exists in technical papers, and whether it's extracted or not, depends wholly upon the reader.

How he conceived and developed the air-brake now in use on all railways was told by Mr. Westinghouse in detail. Its conception, his story revealed, resulted first from an accident and second from the chance that led two young women to canvass his subscription to an engineering magazine, in which was recited the use of compressed air in the driving of Mount Cenis tunnel.

The accident was a collision of two freight trains between Schenectady and Troy in 1866, which delayed for two hours a train in which Mr. Westinghouse was a passenger. Had the freight trains been equipped with brakes of sufficient power, thought Mr. Westinghouse, the collision, with its subsequent loss of time to him, could have been avoided, and immediately he set to work to develop such a brake.

An inventor named Ambler already had perfected a chain brake which was operated by the revolving of a windlass in the engine, the chain thus being taken up and the brake levers of each car thus operated. To Mr. Westinghouse came the idea of exchanging the windlass for a cylinder beneath the locomotive, the piston of which should be of extraordinary length and connected with Mr. Ambler's chain so that the drawing in of the piston by the application of steam from the locomotive would give a more accurate control of the brakes than was possible with the windlass device.

But experiments showed quickly that the piston could not be made long enough to operate the chain on more than four or five cars, and Mr. Westinghouse overcame this difficulty by placing a cylinder beneath each car with a flexible pipe connecting each one to the locomotive for its supply of steam. This effort failed because, even in warm weather, it was found impossible to transmit the steam. Then the young ladies called.

It was then that Mr. Westinghouse saw the article on compressed air, and in the use of this medium instantly saw a solution to his difficulties.

An apparatus employing compressed air instead of steam was built at once and a Steubenville, Ohio, accommodation train of the Panhandle railroad was equipped with the device. On his first test the engineer, as his train emerged from the tunnel near the Union Station in Pittsburg, saw a wagon on the tracks, and the value of the new brake was demonstrated instantly by the short distance in which the train was halted in time to avoid an accident.

Many experiments were made by various railroads, and in 1869 several of these had their running stock equipped with the new brake, but once more the inventor was to face and overcome an obstacle. It developed that it took too long to set and release the brakes, and that in the event of a break in the train the rear section would be without brakes. The first automatic air brake grew out of the need to provide against this contingency.

Of the lives which his brake may have saved in its prevention of railroad accidents, Mr. Westinghouse quoted a diplomat at the International Railway Congress in Washington in May, 1905, who declared that he felt safe in saying that "The air brake has saved more lives than any general ever lost in a great battle."

Mr. Westinghouse found the solution to his problem in the reading columns of an engineering paper.

Reading and advertising columns are twin brothers—the one tells "how," the other shows the devices which have been invented and marketed to help.

No progressive man can afford to overlook either any more than he can afford to cut out food and drink.

* * *

Only reliable products can be continuously advertised.

Cold Swaging Dies for Steel Parts*

By D. H. Chason

Small composite parts consisting of two or more members, whose functions must bear a certain relation to each other and to those of the other members, are by this method accurately made from a single blank. In this way tedious assembling operations with their incidental inaccuracies are dispensed with.

*Copyright, Hill Pub. Co., 1912.

Having recently been called upon to design several sets of swaging dies, to accomplish a saving of cost in the production of parts requiring extreme accuracy and maximum durability, a description of the methods employed and results obtained may prove of value to those who may have similar problems to solve.

In Fig. 1 are shown the various operations necessary to complete this part. The operations indicated at *A*, *B*, *C*, *D* illustrate the old method of manufacture, while *E*, *F*, *G*, *H* and *I*, Fig. 2, indicate the new. To give a better idea of the amount of labor saved by the use of swaging dies for this class of work, a little space will be given to the description of the former methods employed.

The Old Method

The blank *A*, Fig. 1, is turned from a bar of cold-rolled steel in the screw machine. The outside diameter is $\frac{5}{8}$ in., the diameter of shoulder $\frac{7}{16}$ in., and the bore $\frac{1}{4}$ in., the total thickness being 0.100 in. and the width of the shoulder 0.050 in. The next step was the broaching of the internal gear. Owing to the extreme accuracy and smooth finish required, it was found necessary to use a set of four broaches about $3\frac{1}{2}$ in. long. These were forced through the blank in an arbor press, the first broach taking the rough cut and the fourth finishing.

After broaching, it was necessary to remove the burrs on the underside of the blank to enable it to be squared up in the milling fixture for the next operation, which consists of end-milling the blank to form the single tooth, as shown in *C*, Fig. 1. The milling referred to took a considerable amount of time. In order to prevent the fillet, left by the mill when forming this tooth, from interfering with its meshing gear, a $\frac{1}{8}$-in. end mill had to be employed, and any tendency on the part of the machine hand to increase his output, promptly results in the breaking of the mill. It might not be out of place here to mention that this operation alone took as much time as the making of from six to eight complete parts by the swaging process.

The next operation consists of trimming the external gear, the thickness of metal in this part of the blank is 0.020 in., 0.030 in. of the original 0.050 in. being removed when milling the single tooth. The external gear is 60-pitch involute, there being 40 teeth, which brings the outside diameter of the finished part to 0.618 in. A single tooth of this gear must exactly line up with the single tooth formed by milling, which produces at this point a single tooth in the gear 0.050 in. wide. The part appears now as shown at *D*, Fig. 1, and after pack-hardening, is complete.

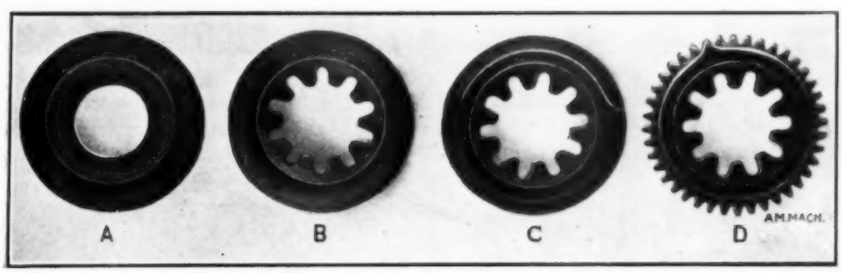


Fig. 1. The Old Method (Nearly Double Actual Size)

The New Method

The first operation, namely, punching the simple blank, shown at *E*, Fig. 2, needs no description. It is 0.550 in. diameter and $\frac{1}{8}$ in. thick. The second operation consists of piercing the internal gear, and the constructive details of the punch or die for this operation are shown in section at Fig. 3, in which *J* is the bolster of the subpress upon which is mounted the die holder *P*, into which the die *Q* is a press fit.

The stationary member of the nest is *K*, and *L* its movable counterpart; these are made of tool steel and hardened. *M* is a block sliding in a groove provided for it in the die holder *P*, to which the movable half of the nest *L* is attached by means of flat-head screws, as shown. *R* is a spring, which allows the movable half of the nest to follow the wedge *C*. *O* is a hardened plate let into a groove provided for it in the die holder, and serves as a thrust bearing for the wedge *C*.

N is a stud holding the block *M* to the die holder, a slot being provided to accommodate its movement. *A* is the upper half of the subpress, *D* being a plate provided for holding the punch *G*. *I* is the stripper supported by four screws, indicated at *E*, and kept in alignment by two heavy guide pins shown at *T*, the stripping being accomplished by suitable springs shown at *F*, four such springs being used. The bushing *H* is made of tool steel, it is a snug fit on the punch *G* and a press fit in the plate *I*, this bush, as well as the die, being keyed in position by suitable pins to prevent the punch and die from coming out of alignment. *B* and *B'* are the subpress guide rods, and

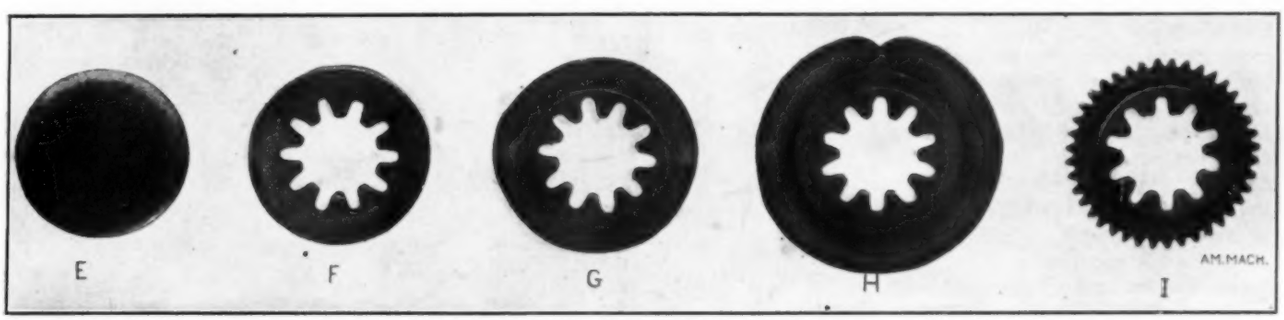


Fig. 2. The New Method (Nearly Double Size)

are exceptionally heavy, to insure a rigid and accurate alignment of the punch and die. The operation of this punch and die is as follows:

A blank, such as shown at *E*, Fig. 2, is inserted in the space *S*, between the movable and fixed parts of the nest, which opening is just sufficient to allow its passage into the half-round recess cut in the plate *K* to accommodate it, and thereby properly locate the blank over the die.

The movable plate *L* has a similar recess, and when the ram descends, the wedge *C*, acting against the plate *L*, causes it to approach and bear against the blank, holding it firmly in place. This movement is so timed that the plate *L* has completed its action before the bushing *H* has come in contact with the blank. The nest plates are made slightly under the height of the blank to insure the full pressure of the stripper springs coming on the blank and holding it securely in place, thus acting as a powerful pad.

The hardened-steel bushing *H* in the stripper plate *I* is a snug fit on the punch *G*, and when it is forced down against the blank, it serves as a shroud for the punch. This fixture renders it possible not alone to pierce this thickness of stock without injury to the punch, but also insures a perfectly smooth perforation by checking the tendency of the punch to crowd away from the blank when starting.

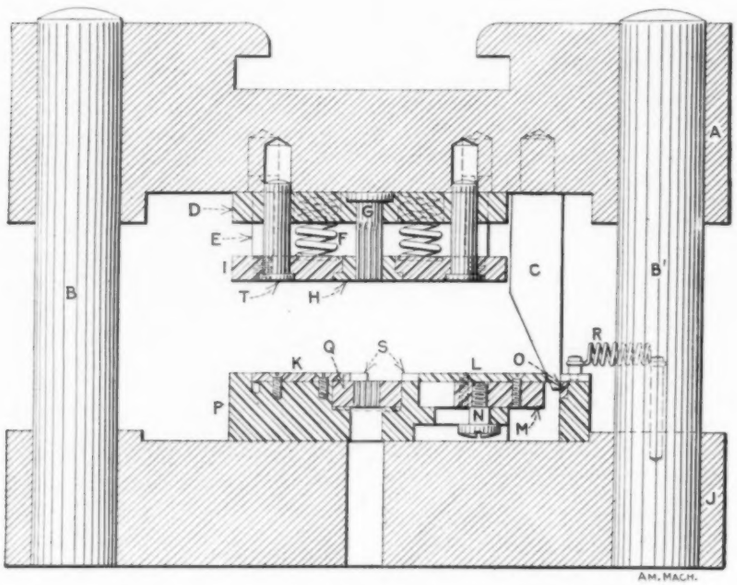


FIG. 3. PIERCING DIE FOR PRODUCING *F*, FIG. 2

THE FIRST SWAGING OPERATION

The first swaging operation forms the shoulder, shown at *G*, Fig. 2. As the subpress construction for this and all subsequent operations is identical with the one shown in Fig. 3, we will proceed with the description of the die and anvil shown in Fig. 4.

The anvil holder *A* is suitably attached to the bolster *J*, into which the anvil *B* is a sliding fit. *C* is the pilot which is a press fit in the anvil holder, and a sliding fit in the anvil, the shouldered end of it bears against the bolster of the subpress. The anvil holder keeps it firmly in place. *D* and *D'* are two of three pins spaced equally on a circle, and actuated by the disk *E*, provided with a shank *G*, to insure a smooth action and eliminate any tendency to cant and bind in its chamber, the washer *F* being provided to prevent the disk and pins from falling out when removing the subpress. The action is as follows:

The blank, after being swaged, firmly hugs the pilot, and after the ram has completed its upward stroke, a knockout arrangement attached to the press acts upon the disk *E*, forcing it upward. This movement being transmitted to the anvil through the medium of the pins, causes the anvil to rise enough to shed the blank. *H* is the swaging die, which is bored, hardened and ground to conform to the diameter of the shoulder being swaged, the depth of the shoulder being regulated when setting the press. The die operates in the following manner:

The blank shown at *F*, Fig. 2, is laid on the anvil *B*, the pilot *C* holding it in place. The pilot is slightly tapered at the end, to allow the blank to be easily placed in position. The actual seating of the blank on the anvil does not take place until the die *H* bears against it. This tapering of the pilot is not carried far enough from the end to interfere with the absolute fit required of the internal gear in the blank on the pilot *C*, which

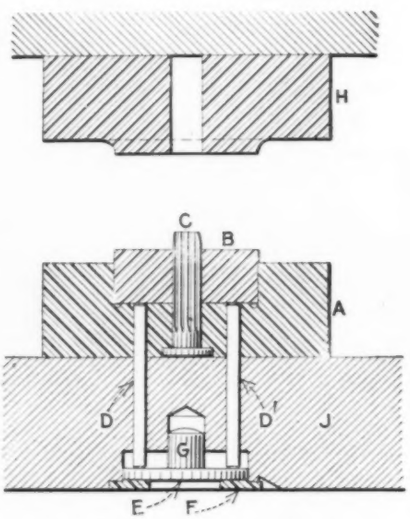


FIG. 4. FIRST-OPERATION SWAGING DIE

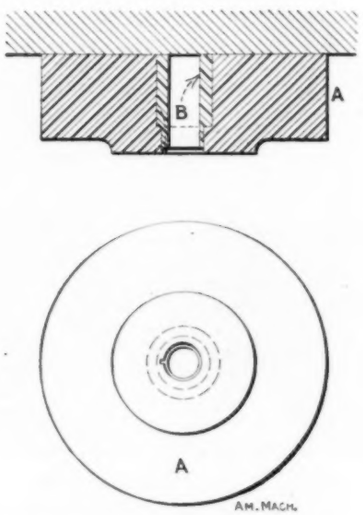


FIG. 5. SECOND-OPERATION SWAGING DIE

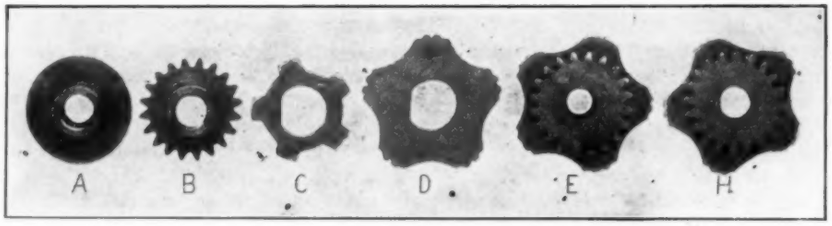


FIG. 6. THE OLD AND NEW METHODS (ABOUT DOUBLE ACTUAL SIZE)

is necessary to guard against any distortion when swaging.

The die *H* now descends, flattening the blank between itself and the anvil, and leaving a shoulder of the original thickness of the metal in the blank, and equal in diameter to the bore of the die. The die, on coming in contact with the blank, flattens it out to the thickness required, this being regulated by the setting of the press. The hole in the male portion of the die *B* is made a snug fit on the first shoulder swaged and the distance between the face of the male and female portions of the die controls the height of the second shoulder and single tooth. This completes the swaging operations. The next step is the trimming of the external gear.

The details of this operation will not be considered further than to remark that the internal gear, pierced as explained above, is also used as the locating medium in this, the final press operation. Upon being pack-hardened, the piece is now complete, as shown at *I*, Fig. 2.

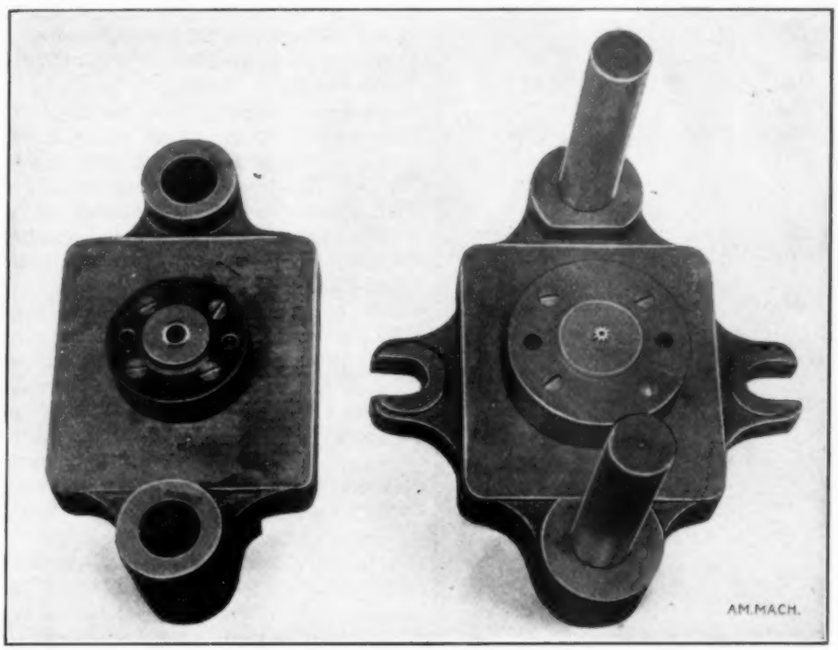


FIG. 8. DIE FOR *G*, FIG. 2

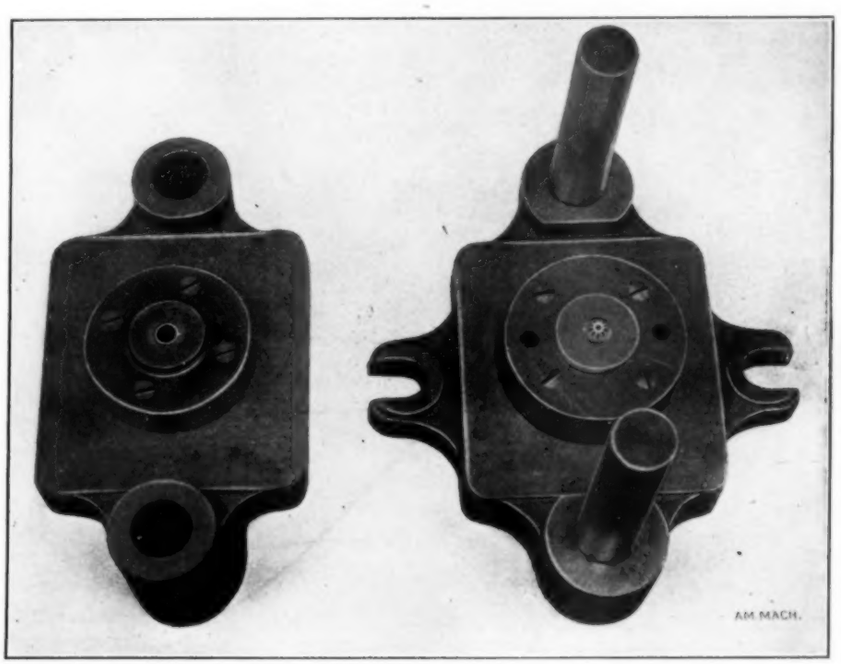


FIG. 9. DIE FOR *H*, FIG. 2

shedding process having already been explained, the next operation will be considered.

SECOND SWAGING OPERATION

This, as shown at *H*, Fig. 2, consists of swaging the second shoulder and single tooth. The anvil used in this operation being exactly the same as shown in Fig. 4, we will not repeat its description, but pass on to the die, shown at Fig. 5.

This, as will be seen, is composed of the female portion *A* and the male portion *B*. This construction being adopted, owing to the ease with which the die may be sharpened, it being only necessary to grind a similar amount from both members to keep its original proportions. The operation of this die is shown as follows:

The blank shown at *G*, Fig. 2, is located on the anvil, as already described.

MAKING THE PART SHOWN IN FIG. 6

Now comes the interesting little part shown in Fig. 6, and, as before, this will be prefaced with a description of the old method of manufacture, to better illustrate the advantages of the new.

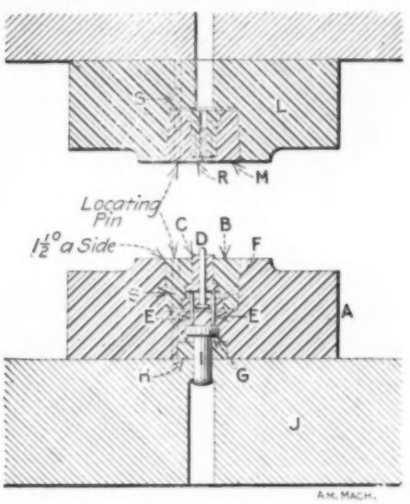


FIG. 7. DIE AND COUNTERDIE FOR *G*, FIG. 6

THE OLD METHOD

At *A*, *B*, *C* and *D*, Fig. 6, are shown the several pieces which constituted this part, as made by the old method, and at *E* and *H* front and back views of the completed parts. The first operation indicated at *A*, Fig. 6, consisted of turning the blank from cold-rolled steel bar in the screw machine. The outside diameter, 0.330 in., the diameter of the hub, $\frac{5}{32}$ in., and the bore, $\frac{3}{32}$ in., the thickness of the gear blank being 0.026 in., and width over all 0.110 in. The next step was the milling of a flat on the hub to register the proper relation of the various pieces composing the part.

Now comes the next operation, indicated at *B*, Fig. 6. This consisted of trimming the gear teeth in the blank, the flat milled on the hub being the locating point

for this operation. This gear is a 20-tooth 60-pitch involute and runs in mesh with the gear shown at *I*, Fig. 2. The next piece shown at *C*, Fig. 6, constituted the five-toothed portion of the composite gear, and was punched from 0.042-in. sheet metal, a flat being formed when piercing to correspond to the flat on the gear hub previously mentioned.

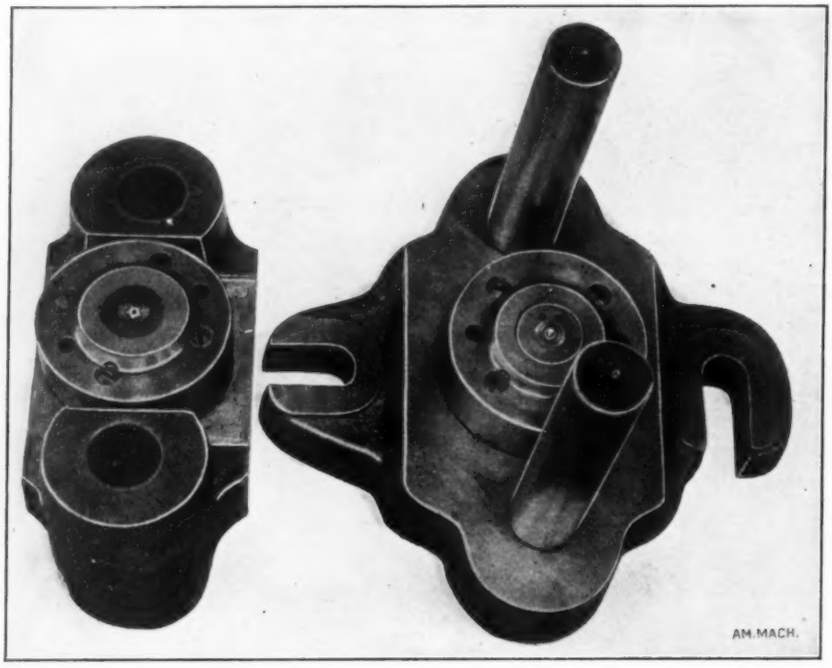


FIG. 10. DIE FOR F TO G, FIG. 6

The next piece, shown at *D*, Fig. 6, is the intermittent gear member, and was also punched from 0.342-in. sheet steel, the flat in the hole showing plainly. The pieces *D* and *C* are now forced upon the hub of the gear *B*, Fig. 6, on which they are a press fit, the location being accomplished by means of the flat already referred to. Pin holes were drilled through the components and pins inserted and riveted in place, the part being then ready for the pack-hardening, which completed it.

DISADVANTAGES OF THE OLD METHOD

The disadvantages of this form of construction are principally the difficulty experienced in keeping the pieces, composing the part, from becoming detached from one another when performing their respective functions. It might be stated here that the pins last referred to were not included in the original design, but were introduced some time later to overcome this difficulty. The only seeming advantage gained by their introduction was delaying, for a while, the ultimate breakdown. This will probably be more apparent to the reader on noting the small proportions of the part, which has to stand considerable shock in performing its work, and the absolute accuracy required in the relative position or timing of its various members.

Although no effort was spared to make these pieces a firm fit to the hub of the main member *B*, Fig. 6, there was always a slight variation caused when hardening the part, owing to the impossibility of preventing some little distortion during this process. This shake at first was so small as to almost defy detection, but after the part had run for a while, the impact it received when performing its function magnified this shake until the part became useless.

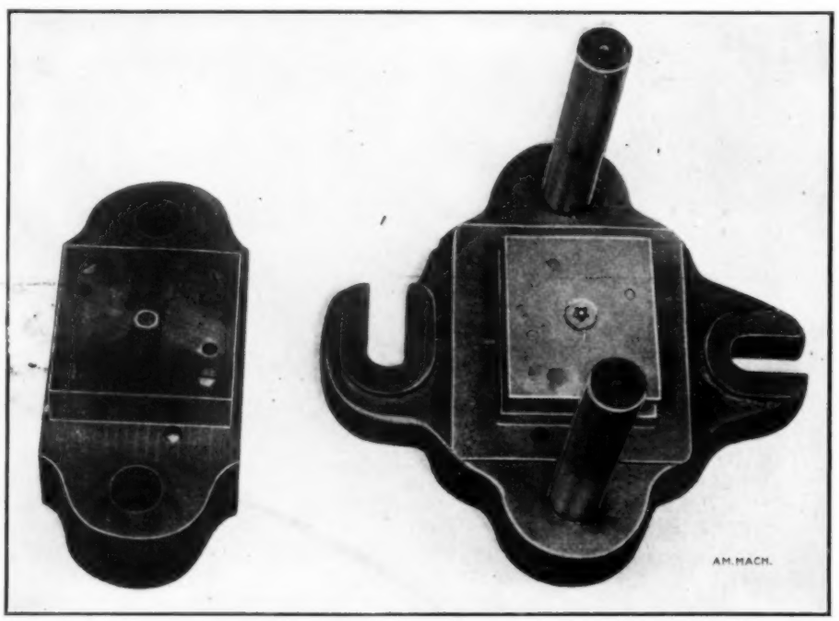


FIG. 11. LOCATES *G*, FIG. 6, BY THE FIVE LOBES ON ONE SIDE AND TRIMS THE OUTSIDE, PRODUCING *H*

THE NEW WAY

These conditions naturally led to the making of this old part in one piece. The die and counterdie used are shown in Fig. 7, and mounted in a subpress similar to that shown in Fig. 3. At Fig. 7 is indicated the subpress bolster, upon which is mounted the die holder *A*, into which is fitted the die *B*.

Attention is called to a feature which has been found quite advantageous, namely, the making of the die slightly taper. This insures the easy removal of the die when necessary, and also permits conveniently placing it over the pins provided for its location in the die holder, when driving it in place.

At *D*, Fig. 7, is shown the pilot which is a drive fit in its retaining disk *F*. At *C* is shown the shedder, which is an accurate fit to the die and pilot, this shedder being operated by means of the knockout arrangement provided on the press. At *L* is shown the counterdie holder, which is secured to the upper portion of the subpress, *M* being the female portion of the counterdie, and *R* the male portion which regulates the height of the five-tooth portion of the part. This construction has been adapted, as already explained, to facilitate resharpening when necessary.

OPERATION OF THE DIE

The operation of the die is as follows: The blank *F*, Fig. 6, is pierced and punched in a follow die; it is then placed on the pilot *D*, which is an accurate fit in the hole in the blank. The ram in descending forces the blank into the die *B*,

the depth of flow being regulated by the amount of travel of the shedder *C*, which is just sufficient to give the proper width to the teeth shown at *G*, Fig. 6. While this is taking place in the die *B*, the five-toothed portion is being formed in the counterdie, and the fin shown at *G*, Fig. 6, is at the same time brought to its required thickness. After the ram has ascended, the plunger of knockout is then brought to bear against shank *I* of disk *G*, Fig. 7, transmitting its motion through the medium of pins *E* and *E'* to the shedder *C*, thus ejecting the blank.

The last press operation is the trimming of the intermittent gear. This operation requires no detail of tools further than to state that the piece is located from the five-toothed portion when trimming. After this the parts are ready for hardening.

In concluding, attention is called to a feature which may be considered more than the reduction in cost of production, viz., the increased strength of the parts made by the swaging process. This has been ascertained by actual experiment and a little example may prove interesting.

After case-hardening the part made from bar stock, it was found that very little force was required to break the teeth of the gears; the chief cause of this weakness being due to the fact that the grain of the bar stock runs parallel to the axis of the gear, and so makes the teeth the weakest directly in line with the stresses met with while the piece is performing its functions. This disadvantage is greatly reduced when using swaging process. The metal under this treatment becomes practically homogeneous.

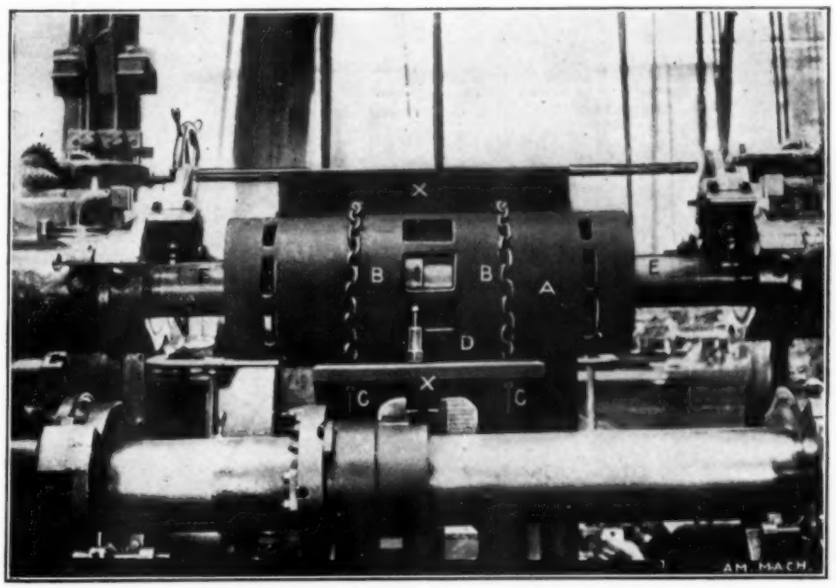
A tooth of the gear made by swaging was bent over at an angle of 90 deg. before rupture took place, while a gear made from the bar and treated similarly broke down before any appreciable amount of bending was done, the tests being made on parts that had been pack-hardened in one heat. Four of the subpress dies used in the work are shown in Figs. 8, 9, 10 and 11. These will serve to give a general idea of the construction. It must be remembered that Figs. 1, 2 and 6 show the parts larger than natural size.

Boring Piston Valve Bushings

A cylinder or piston-valve bushing is not an easy thing to hold, especially for boring, on account of the comparatively thin walls, and the danger of springing them, unless the necessary pressure is very evenly distributed. The illustration shows the methods used in the Chicago & Northwestern Ry. shops in Chicago, and which has the merit of extreme simplicity to recommend it.

The holding device consists of the angle plate *XX*, the chains *BB* being fastened to the vertical side of the angle so that when the bushing *A* is put in place and the eye-bolts *CC* put through the lower part of the angle, the bushing is held firmly in place by nuts on the eye-bolts, drawing the two chains around the bushings. This not only locates it accurately, by forcing it into the corner of the angle plate, but it also distributes the holding pressure very evenly around it and avoids undue springing.

The small screwjack *D* is adjusted to fit between the angle plate and one of the bridges across the central part, and acts as a support to prevent any tendency to turn under pressure of the boring tools. This device has proved very satisfactory, and has become standard practice on this road.



HOLDING PISTON-VALVE BUSHINGS FOR BORING

More Power for Old Machines

BY F. P. STRACHAN

It is very difficult for the machine-shop foreman, who has to keep on with the old drilling and boring machines, to obtain a satisfactory return with high-speed steel drills and cutters, owing to the lack of sufficient belt power. The following method will overcome this:

On the first and third step of the four-speed cone pulleys I have fitted hard-wood blocks, truing these to give me two speeds, instead of four as previously, and allowing for a belt exactly double the width of the former one. Where necessary I also increased the speed by the addition of a larger pulley on the main shaft and in some cases the feed was also altered to be more useful for the high-speed drills.

I have not found any difficulty from the smaller range of speeds, as the work is allocated to the best advantage. The increased output has quite justified the change, some of the old machines giving very nearly as much work as new ones.

Possibilities of Peat for Fuel Purposes

Peat has long been generally used in Europe as fuel for heating and other domestic uses, and more recently for power generation. Its production in compacted forms suitable for transportation and storage is growing constantly, so that at present every European country having any considerable area of peat deposits is increasing the output of peat fuel. In addition, Ireland and the countries of continental Europe are encouraging its use by direct appropriation of funds to aid new and promising methods of preparation, and are supporting experiment stations for investigating and perfecting new processes for utilizing this important natural resource.

In some parts of Canada, because of climatic conditions, the lack of any considerable deposits of coal, and the existence of generally distributed and extensive peat beds, more or less successful attempts have been made for 50 or more years to utilize peat as fuel. The matter has recently received new impetus there because of an industrial awakening and because of improvements made in gas producers and gas engines in Sweden, Germany and the United States that permit satisfactory use of low-grade fuels. As a direct result of these factors, an experimental gas power station using peat is being established under governmental control and thoroughly equipped with the best European machinery.

Jigs of the Saurer Motor Factory

By Ethan Viall

Jones & Lamson, Gisholt and regular faceplate jigs, as well as a number of milling and drilling jigs that show the shop practice.

An unusually steady adjustable angle plate and an interesting clutch milling fixture.

Turret-lathe work forms an important part of the shop practice of an automobile factory, so any special fixtures used on machines of this class generally attract attention and the Saurer Motor Co., Plainfield, N. J., is well equipped in this line, though room for only a few turret lathe fixtures is available in this article, the rest being for milling or drilling.

A faceplate fixture used for holding sprocket-shaft housings on a Jones & Lamson, the pieces having been previously milled and drilled, is shown in Fig. 1. The method of locating the piece is shown in Fig. 2; the reamed hole *A* fitting over the pin *B* and the milled surface *C* fitting the block *D*, clamps *E*, *F* and *G* holding it in place.

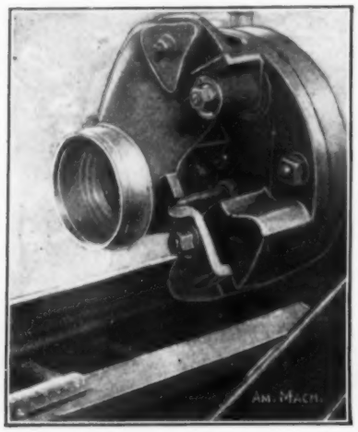


FIG. 1. LATHE FIXTURE FOR SPROCKET-SHAFT HOUSING

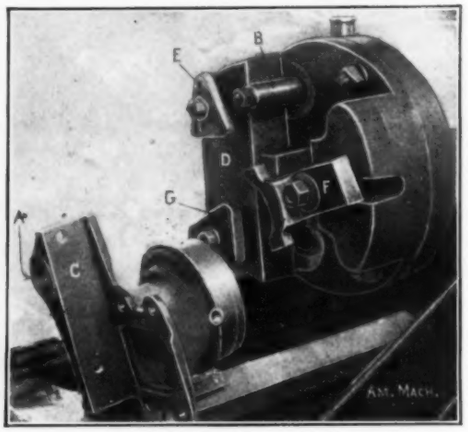


FIG. 2. FIXTURE WITH HOUSING REMOVED

Jones & Lamson adapter plates for wheel hubs are shown in Figs. 3 and 4. The hubs are located over plugs in the center of the plates and clamped by hook clamps over the rim of the flange. Of course, these hub parts are first bored and machined on one end while held in a chuck and are then placed on the adapter plate and the opposite end finished, the plate and plug acting practically the same as a mandrel.

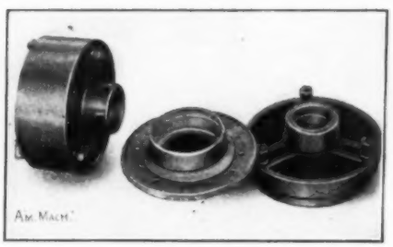


FIG. 3. JONES & LAMSON ADAPTER PLATE FOR WHEEL-HUB FLANGE

FIG. 4. ADAPTER PLATE AND OPPOSITE PART OF HUB

Radius-rod straps are first drilled and the clamping bolt put in place, the shank turned, the threaded bushing slipped over the shank and locked with the nut; then they are placed in the faceplate jig shown in Fig. 5 and the ring faced off and bored out to fit the sprocket shaft housing shown in the first illustration.

FACEPLATE JIGS

Differential brake shoes are first drilled and reamed, then placed on the faceplate jig, Fig. 6, and bored out, being located by means of the reamed holes which fit over pins in the jig, holes *A* and *B* fitting over pin *C*; hole *D* over pin *E* and hole *F* over pin *G*, the clamps *H*, *I*, *J* and *K* holding the pieces in place.

Another faceplate jig is shown in Fig. 7 which is used for holding three cross-member slides while turning them to the proper radius. These slides are first milled at *A* and *B* and the holes drilled, after which they are easily located on the jig by means of dowel pins which fit the drilled holes, suitable clamps holding them down and thumb screws being used to back the pieces under the cut. A feature of this jig is the setting pin *C*, by which the jig may be quickly set

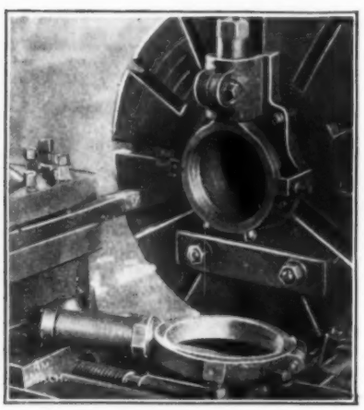


FIG. 5. RADIUS-ROD STRAP BORING FIXTURE

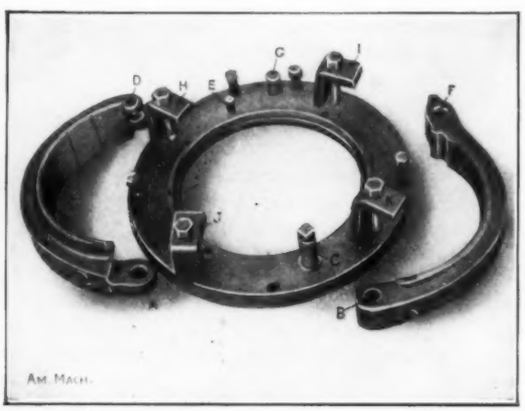


FIG. 6. BORING FIXTURE FOR DIFFERENTIAL-BRAKE SHOES

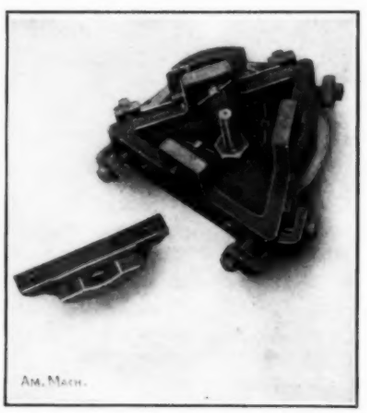


FIG. 7. TURNING FIXTURE FOR FRONT CROSS-MEMBER SLIDES

approximately true and then brought absolutely so by means of an indicator.

Boring and Milling Jigs

Cross members are bored out as shown at *A* and *B* and turned as at *C*, Fig. 8, in the jig shown, which is used in a horizontal boring mill. The main part of this jig is cast in one solid piece, well braced between the uprights at *D*, *E* and *F*, and webbed wherever necessary. A hinged setting gage used to assist in placing the cross member central is shown at *G*, and as soon as the piece is set, the gage is dropped down out of the way of the boring bar.

These cross members are milled, previous to boring, in the jig shown in Fig. 9, the surfaces *A*, *B* and *C* being milled. In this jig it will be noticed that thumbscrews are used wherever needed to compensate for the unevenness of the casting and make it rigid during the cuts.

The slots in steering-gear ball housings are milled with an end mill in the jig shown in Fig. 10, a set of parts being shown at *A* and *B*, the slots being indicated by *C* and *D*. Of course, the studs are not set into part *B* until after the slot is milled, but the inside is rounded out and the holes are tapped, so all that is necessary to locate the pieces in the jig is to slip them over the knobs and dowel pins, and screw in the clamping bolts, the jig holding both sizes equally well.

Milling and Drilling Steering Housings

A milling jig for holding the steering housing, which is a very irregularly shaped casting, is shown in Fig. 11. This casting is first chucked in a lathe and bored out at *A*, after which it is clamped in the jig as shown in Fig. 12 and milled at *B*, then the piece is placed in the jig shown in Fig. 13 and all the holes drilled except the one at *C*, which was done when the piece was bored; the housing is set into the jig and the bevel-headed bolt *D* is slipped down through the hole *C*, the bevel-head resting on the rim of the bored hole, a nut underneath being used to tighten it. The taper pin *E* is forced in across the milled surface locking it square with the outer edge, the taper allowing for any slight variation in distance between the milled surface and the bored hole. The setting of

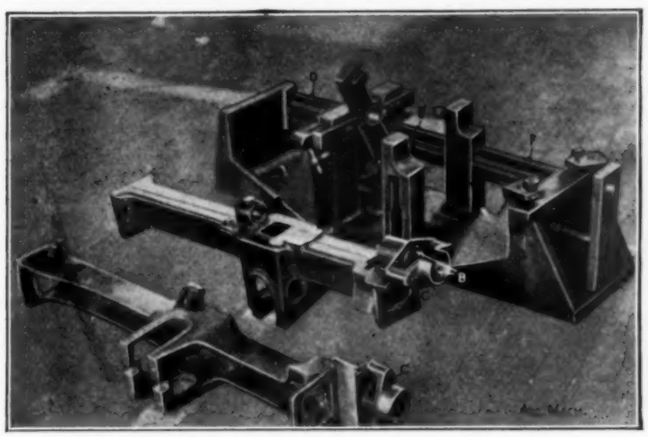


Fig. 8. Cross-member Boring Fixture

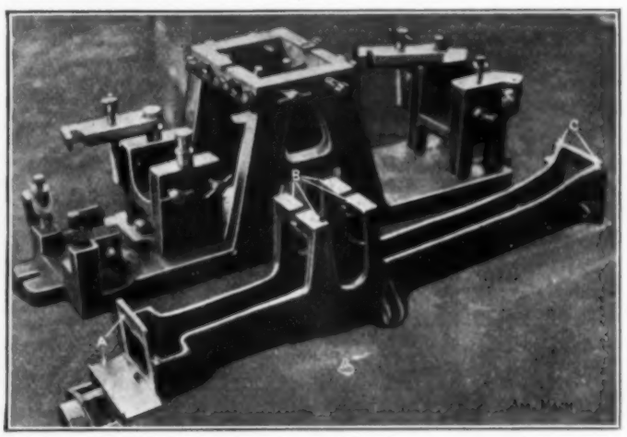


Fig. 9. Cross-member Milling Fixture

Fig. 10. Slot-milling Fixture for Steering-knuckle Ball Housing

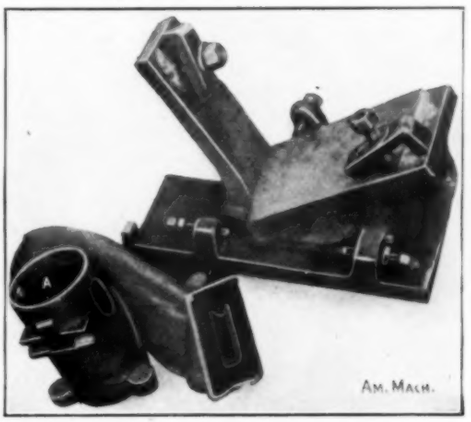


Fig. 11. Milling Fixture for Steering Housing

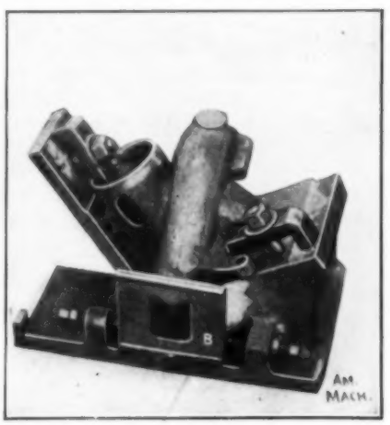


Fig. 12. Steering Housing in Position for Milling

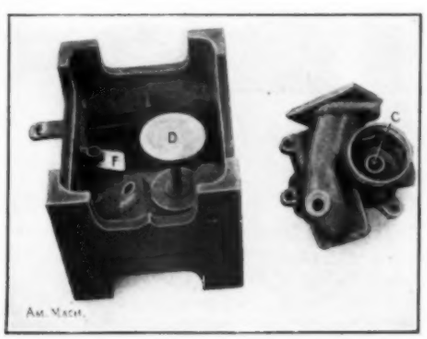


Fig. 13. Drilling Jig for Steering Housing

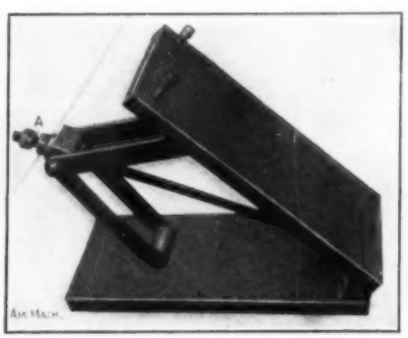


Fig. 14. Rigid Type of Adjustable Angle Plate

clamp *F* completes the clamping operation and the piece is ready for drilling.

An adjustable angle plate, Fig. 14, is used for various purposes, and has the advantage of being more rigid than many of this type because of the long supporting bolt *A*, which passes through the middle of the toggle.

Milling Starting-crank Clutch-teeth

An interesting milling fixture for milling the clutch-teeth *A* on starting crankshafts, is shown in Fig. 15, the fixture being shown partly disassembled in Fig. 16. The shaft is held in the hollow spindle of the fixture by the hand nut *B* which screws on the end *C*. The pin *D* is placed in the hole *E* and engages the cam slots *F* and *G*, so that when the handle *H* is turned by hand the work is fed onto a small milling cutter.

As soon as one clutch-tooth is milled the handle *H* is thrown back, the pin *D* withdrawn, and inserted in the other slot in the spindle, a number of holes being provided in the spindle flange so that the handle may be placed in a convenient position for the operator.

Straightening Foot-brake Levers

A straightening jig used in the blacksmith shop for lining up foot-brake lever forgings is shown in Fig. 17, the jig with the forging removed being shown in Fig. 18. The holes *A* and *B* in the forging are first drilled and reamed, then it is placed in the jig by slipping the rods *C* and *D* through these holes, the piece *E* acting as a gage for the pedal lever and the block *F* as a gage for the brake-shoe lever, the forging being heated and hammered or twisted to make it conform to the gage.

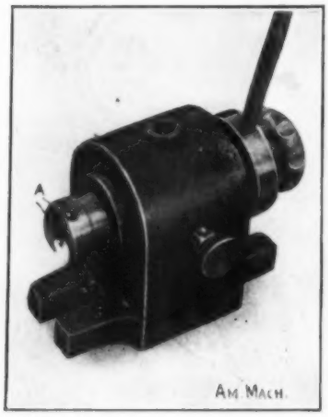


Fig. 15. Starting Crankshaft Milling Device

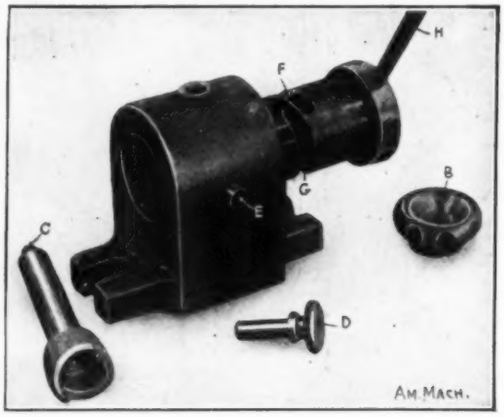


Fig. 16. Device Partly Disassembled to Show Construction

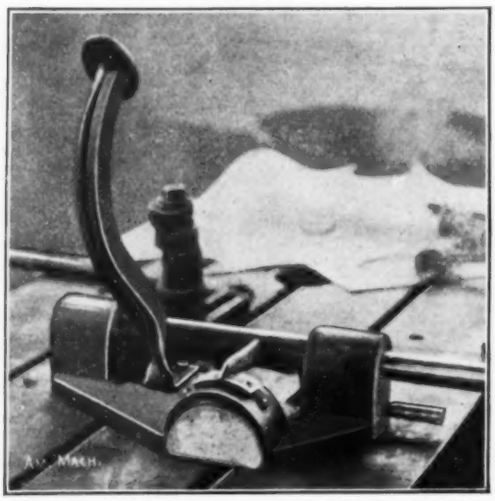


Fig. 17. Straightening Fixture for Foot-brake Forging

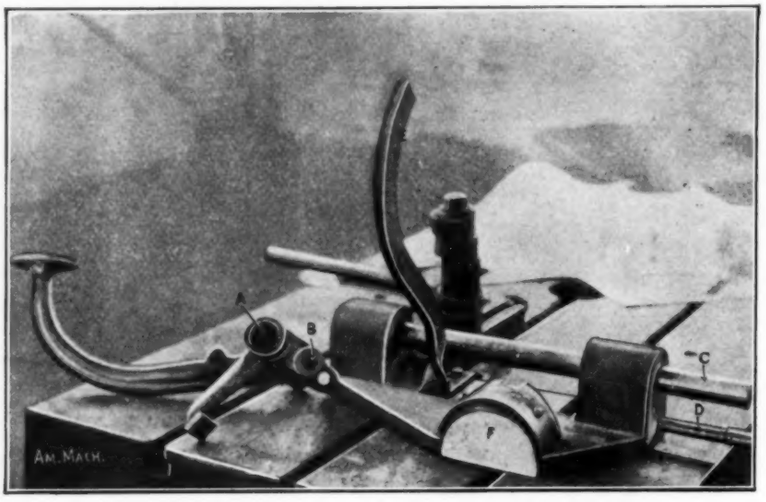


Fig. 18. Fixture for Gaging, with Foot-brake Forging Removed

A Special Memorandum System

By J. G. Russell

A novel scheme which may be new to most readers, is a system of memoranda to keep track of matters which are to come up later; i.e., there are many little matters which come up both in the shop and office which it is desirable to take up with the manufacturer of this or that but which it is preferable to see someone personally about, rather than to write. A mental note is therefore made that when Mr. Smith of the Brown Manufacturing Co. comes we will talk with him about this; but when Mr. Smith shows up the matter has slipped from the memory, and is perhaps recalled only when he is on the train out of town.

To overcome this a loose-leaf memorandum book is provided with proper index leaves, and when such a situation arises as indicated above, a note is made on the properly indexed page. When Mr. Smith arrives the first thing that the purchasing agent or superintendent does is to consult the memorandum.

An example of the accuracy and precision to which the electrolytic etching process can be brought, is pointed out by *Werkstattstechnik*.

The metallic surface is covered with a thin layer of a mixture of 2.6 gal. naphthalene, 0.27 lb. carbon disulphide, 4.4 lb. powdered resin, and 3.3 lb. copper chloride. A thin coat of this is put on, and by means of a die, which had first been cleaned with a weak caustic-potash solution, the design is pressed into the coating. Then the particles pressed out by the die are washed off with water; the entire coating is covered with a weak solution of ammonia or brine, a clean metallic surface laid on top and connected to the negative pole of a battery, while the metallic object which is to be etched is connected with the positive pole.

Then the electric current passes between the object and the metallic surface, through the ridges cut into the resin coating, so that after a short time the pattern is etched in sharp, clear, deep lines, after which the surface is washed with a soda solution.

A Swiss Works Continuation School

Special Correspondence

A large machine shop conducts its own classes for its apprentices. Instruction is given during periods taken from the regular working hours; the school therefore appeals to the apprentice as an important, as well as agreeable part of the shop work.

Outlines of the courses of study, and other details.

The firm of Sulzer Brothers, Winterthur, Switzerland, and Ludwigshafen a. Rh., Bavaria, Germany, has developed from a small industry on a handwork scale to its present proportions, known the world over, and its history has been characterized by diligence, substantiality and solidity. Many years ago, when his foundry still ranked as a small industry, the metal founder, Jacob Sulzer, father of the subsequent first Sulzer brothers, educated his sons in an extremely careful manner. They received, in addition to an excellent training in handwork, not only good school instruction, but a theoretical education which was uncommon under the conditions then prevailing. His eldest son completed his training in the then most celebrated technical school, Ecole des Arts et Métiers, Paris. Moreover, the son Sulzer-Hirzel, who was able in himself sufficiently to appreciate the value of a good education, shared the opinion of his father. In later years he became proprietor of the firm of Sulzer Brothers, established in 1834, and, in spite of his manifold business activity, gave instruction himself in technical branches at the Winterthur trade school. For many years he taught drawing at this institution without remuneration.

SULZER BROTHERS' WELFARE HOUSE

The firm of Sulzer Brothers has taken pains from the beginning to develop a good staff of skillful, intelligent employees. The fact of having been in the service of the Sulzer firm counts today as a special recommendation, not only for persons ocupying the higher positions, but also for those holding comparatively unpretentious places. The ever increasing demand which the growth of industry places upon the education of shop workmen has caused Sulzer Brothers to take special measures for the adequate instruction of their working staff. After the foundation of the public continuation school at Winterthur, in 1882, they facilitated the attendance of their apprentices at this school, and paid the tuition. In the year 1900, the school hours were arranged in the late afternoon (5 to 6:30 o'clock), and the apprentices were obliged by agreement to attend. In the year 1907, the firm established a school of its own in its welfare building.

Since the object of this school is to train a force of workmen for the firm, the number of apprentices annually employed bears a certain definite relation to the number of skilled workmen in the shop, this being now about 5 to 7½ per cent.

The Requirements for Previous Education

The requirements for previous education on the part of the apprentices are made as simple as possible. Apprentices must have been graduated from a public school comprising a six-year course. Further, in general, they must have completed a course at the secondary school, which can be covered in three years. Among the subjects taught in the secondary school may be mentioned German, French, geography, history, natural history, algebra, bookkeeping, geometry and physics. The standard set for the preparatory education of the apprentices is, to a certain extent, dependent upon the branch of manufacture to which they ask to be admitted; for a coremaker it is less rigorous than for a machinist.

The same applies to the term of apprenticeship, which, for the former, lasts three years, for the latter four years. Only a few of the apprentices desert the business after the end of their terms; about two-thirds remain there. Many who go away return to the factory in later years. Some of the bench-hand (Schlosser) apprentices turn for theoretical education to the Winterthur Technical Institute, and often these also return to the service of their old employer. In special cases the firm gives financial aid to bright young men for a course at the technical institute. The desertion of skilled workmen is gratifyingly small, and the increased efficiency of the trained apprentices redounds to the good of the establishment. The apprentices employed yearly are divided in four parallel classes in such a manner that each of these classes will be related as closely as possible to the line of trade chosen, without, however, drawing absolutely fixed limits. For example, there is arranged a classification like the following:

Founders and molders; builders' hardware makers; copper and boiler smiths; machinists and lathe hands; draftsmen and apprentices for general office work (bookkeeping, shipping, etc.).

As the single classes contain at most 30 students, parallel classes must be formed in order to include the total number of pupils—at the present time there are four for each year's course. The sorting of the student material is, therefore, done according to trade groups, but there is, nevertheless, a grouping according to ability. In part, this latter classification is due to the differences in preparatory education, partly also to the fact that in choosing an occupation intellectual and physical fitness cannot be left entirely out of consideration. As far as permitted by the nature of the subject of instruction, this grouping is made elastic by interchanging the pupils from one class to another.

The hour program extends over three years. It is the same for all departments, except that to founders and draftsmen the course in drawing does not apply, although that in sketching does apply. Notwithstanding that the study plan is the same, the varying levels of average ability of the classes naturally result in some of them going more deeply into the subjects than others.

Apprenticeships for Draftsmen and Office Employees

As apparent from the table of classification, the instruction extends not only

to workshop apprentices, but to draftsmen and also employees of the firm's managing office (shop bookkeeping, shipments, invoice office, storage, supervision of materials, piece- and time-work office). For the draftsmen there is arranged in the school building an apprentice department of their own, placed under the master of the school. There these apprentices are trained for a while in copying drawings, in reading them, and as far as time permits, in the laying out on paper of simple models. Later they are distributed over the designing office of the firm, in which distribution their wishes are considered as far as practicable. Their occupation here consists in copying and tracing from drawings. At the end of the term of their apprenticeship they are also given work in small design drawings to give them ability for independent execution.

The pupils trained for office service must from the start perform practical work in the various offices of the management. They successively complete terms of service in the different shop offices (piece- and time-labor office, storage, shipment, etc.) In this manner they are well prepared for later managerial service which demands a familiarity with the ways of doing things in the subordinate offices. The preparation for draftsmanship and office work is similar to that of shop apprentices in respect to the *instruction*. The plan of teaching is the same, but the office apprentices, as a rule, form a school class by themselves.

The teaching staff is 16 strong, comprising ten engineers of the works and six city teachers, who give instruction here aside from their official duty. The technical branches rest exclusively in the hands of the engineers.

The school is situated in the firm's Welfare House, Fig. 1, which contains simply and practically arranged classrooms with abundant light, air and space. There are provided all the necessary aids to instruction, collections of iron ores and woods for the study of materials, of models for teaching drafting, of instruments for the physical department and also of picture charts and text books for electricity and technology.

The lively interest that the students show in their studies is gratifying. This interest can be accounted for by the fact that the instruction closely adheres to the special needs of the apprentices. There is no wonder that the working out of transmission ratios and cutting speeds for lathes and planers or that similar work awakens the lively interest of the students. Every principle laid down for the shop in regard to the erection, capacity and performance of machinery is traced to its origin, many mysteries are cleared up, and many questions which the student hitherto accepted as fixed facts merely are now understood as results from natural deductions—deductions which apply not only to a particular case, but which the pupil can understand for all cases that fall under the same law. He need no longer remain the slave of usages determined by tradition, but he can to a certain extent choose between alternative possibilities. His previous acceptance of every fact as a fact vanishes; a sound judgment may, in varying degrees, lead to the discovery of the best among several methods.

Naturally, it is not the purpose of the school to train its pupils for designers or for critics of designs, but to furnish them with the means of self-criticism, which shall within certain limits, impart to them the power of discrimination. That no designer's or draftsman's training is attempted for the ordinary apprentices, is evident from the drafting course given them. Less value is attached to the execution than to the understanding of drawings. In view of the limited time available, some of the operations, such, perhaps as tracing, dimensioning and inking, are omitted as time-wasteful formalities, while attention is paid, for example, to making each student proficient in freehand sketching. Results are attained here also which, considering the brevity of the course, may be pronounced very good. These excellent results are in part attributable to the lively interest awakened by the subjects and are influenced by the fact that here every student can exert his individual abilities.

TABLE 1. PLAN OF HOURS

	First Year's Course		Second Year's Course		Third Year's Course	
	Summer	Winter	Summer	Winter	Summer	Winter
Sketching	1	1				
Mechanical drawing			1	1		
Mathematics and arithmetic	1	1	1	1		
Study of materials			1	1		
Physics				1	1	
Mechanics					1	1
German language					1	1
Thread computations for lathe hands						1
Total	2	2	3	4	3	3

The instruction in drafting imparted is only on the Saturday afternoons that are free for the other workmen. The remaining instruction hours fall in the period from 6:30 p.m. to 7:30 p.m., or from 11 to 12 in the forenoon.

Plan of Instruction

The instruction plans of existing schools are difficult to apply elsewhere with exactitude, but as they may present valuable points of suggestion, the study plan of the Sulzer institution will be presented.

Drafting

(One hour a week for two years).

Sketching without the use of the square and compass; figures, lines, circles; simple bodies in elevation, ground plan and section; screws and fastenings, machine parts, and assembled models.

Drawing with the T-square and triangle; projections and details of simple bodies; drafting of machine parts from models; and the reproduction on drawings of the sketches made by the students themselves earlier in the course.

Mathematics and Common Arithmetic

(One hour a week for two years).

Simple and compound proportion; percentage; partnership; commercial arithmetic; mensuration of surfaces and solids; review of algebraic equations and geometrical problems; in well qualified classes, simple logarithmic and trigonometric problems as far as they are a prerequisite for successful instruction in physics and mechanics.

The carrying out of the foregoing program in the short time available is possible only in view of the fact that for the most part it is a review and fixing in memory of what has already been taught in the secondary school.

Study of Materials

(One hour a week for one year).

Properties, occurrence, and recovery of the metals, description of iron, preparation of iron ores, fluxes, fuels, slags.

Blast-furnace plants, blast-furnaces process, blast-furnace products. Open-hearth process, puddling, Bessemer and Thomas processes, Siemens-Martin process and cementation and crucible steels.

Electrical steel production; cupola furnace; iron castings, malleable and steel castings; patternmaking, coremaking and molding; further treatment of wrought iron; testing of iron; working of iron in the machine shop; recovery of copper, tin, zinc, lead, nickel; antimony, aluminum; quicksilver, silver, gold, platinum and alloys.

Physics

(One hour a week for one year).

Theory of solid, liquid and gaseous bodies. Heat; change in volume, thermometer, heat contents, specific heat, spread of heat by conduction, convection and radiation. Sources of heat and its mechanical equivalent; fusion and ebullition; heat motors (steam engine, steam turbine, internal-combustion motors).

Electricity: Magnetism, frictional electricity; electrical influence; electrical currents; electrical measurements, electromagnet and its use; electric alarms, telegraph, electric clock; induction current and telephone; machines for production of currents; electric motor and the electric railway; heating and lighting effects of the electric current; direct and alternating current (three-phase current); electric plants.

Mechanics

(One hour a week for one year).

Composition and resolution of forces; general conditions of equilibrium; reactions of forces, lever, rollers; pulley systems, windlasses, transmission through belts and gears; center of gravity; Guldinus' rule, specific gravity; friction, inclined plane, screw; effect, work and manner of operation of the most important machines; diagrams, brake tests.

The elements of strength: Tension, compression, flexure, rupture, shearing and torsion.

German Language

(Writings, commercial information, etc.)

(One hour a week for one year).

Public advertisements; dealing with supply men; acknowledgments of indebtedness; dealings with customers; dealings with employees; dealings with authorities; subjects for testing recruits.

Thread Computations

(For lathe apprentices.)

(One hour a week for a half year.)

General rules; English lead screw; millimeter lead screw; universal method; multiple-thread screws; triple-gear sets; ratios for converting millimeter into English pitches; ratios for converting English threads into the millimeter system.

Records of Performance

In the third year of the course, the apprentices of the various departments, on the Saturday afternoons when the men are not at work, visit the shop and foundry under the guidance of the appropriate teacher and are there made thoroughly familiar with the work. (The Saturday afternoons are used alternately for such excursions and for instruction in drafting—two hours each.)

At the end of the half year, each student receives a report of performance, diligence and deportment. Also, when he goes away there is usually given to him, together with the general certificate of instruction, a testimonial regarding his attendance at the school. This testimonial, in case of the draftsmen for example, is inserted directly in the general certificate of instruction. Hereby the students are made to perceive clearly the mutual dependence between practical and theoretical training, as also the importance of their school education.

Example

Gebrüder Sulzer,
Winterthur.

Winterthur, June 3, 1911.

Testimonial

We hereby certify that Karl Müller, of Winterthur, from May 1, 1907, to date, has completed a four years' apprenticeship course as draftsman, partly in our tracing office (to June 15, 1908), partly in our designing office for general machinery (pump department), and subsequently, until the present time, has been employed in the last named office.

Upon his voluntary leaving, we gladly furnish him with a testimonial that we were always well pleased with his diligent performance and his deportment in general.

The School Expenses

The expenses of the school amount annually to about the following: Compensation to the apprentices for the working time taken out, $1200; salaries of teachers, $1300; writing and drafting material, $160; cost for instruction rooms, $1200; miscellaneous, $140; total, about $4000. For 330 pupils this comes to about $12 a pupil a year.

A school conducted according to about the same principles is maintained by the firm also in its factory at Ludwigshafen. That school was established in 1907, and after a previous enlargement was, in May, 1909, recognized by the Royal Bavarian government, under the condition that final examination should be passed before the public industrial continuation school, and that the principal of this school should have the right of oversight. The number of students (about 90) is divided into three classes, each with four hours a week. The students in Winterthur, as also in Ludwigshafen, attend exclusively the works continuation school. Their hours at the public institutions are entirely eliminated.

The Results Have Been Gratifying

The firm is very much gratified with the school discipline, as also with the results of the studies. The fact that the instruction is not supplementary to shop activity, but falls before or within it, has a noteworthy and good result. The scholars thus go to their school fresh in body and mind and are able to concentrate fully upon their lessons.

Since shop work and school work are separated no more in place than in time, as distinguished from ordinary continuation schools, the entire apprentice training course is given a stamp of unity. The school appears to the apprentice to be a part of his training, as well as the shop, and generally the more agreeable part, because it is the briefer and brings a welcome change in the day's work. The consciousness that the master attaches great importance to the boys' theoretical education, so great importance that he has furnished a school himself for that purpose, penetrates directly into the mind even of the simple apprentice, awakening his understanding of the significance of the matter and inspiring a sense of his duty. Only in exceptional cases is it necessary to admonish the scholars to industry. Zeal for learning is also spurred on by premiums for good performance, such as drawing instruments, slide rules and micrometer calipers. During school time, the apprentices are paid their full hourly wage regardless of the time taken from work. The necessary school material, books, etc., are furnished them free, and in general, everything is done to avoid lessening their pleasure in learning by reason of expense or loss of earning time. The results are shown not only in a deepening of trade knowledge, but there is perceptible an important influence upon the pupils in their behavior.

Continuation School: Karl Müller, of Winterthur, attended our Apprentice Continuation School from May, 1907, to April, 1910, and received the folowing graduate certificate:

Department	Diligence	Performance	Deportment	Department	Diligence	Performance	Deportment
General arithmetic	1	1	1	Mechanical drawing			
Sketching	1	2	1	Mechanics	1	1–2	1
Study of materials	1	1–2	1	German language	1	1	1
Physics	1	1	1	Thread computation			

Remarks:

Meaning of the figures: 1, signifies very good; 2, good; 3, satisfactory; 4, unsatisfactory.

Winterthur, June 3, 1911. (Signed)

Late published official reports covering the industries of Chile for 1910 show a healthy growth, notwithstanding there were 51 fewer establishments running and there were 4756 fewer operatives. There was more uptodate machinery in use, which increased the output even with a smaller force. The capital invested in 1910 amounted to $88,263,313 (United States gold) against $79,949,166 for 1909, with a total production of $111,613,722 for 1910 against $107,643,506 for 1909. During 1910 raw material was consumed by these factories to the value of $60,020,181, of which 34 per cent. was imported. There are 2639 industrial establishments in Chile using power machinery aggregating 58,895 horsepower, consisting of the various forms of engines and motors.

High Pressure Fire Gate Valves

By George J. Henry, Jr.

The system planned to protect San Francisco from fire.

The new high-pressure gate valves used and the way in which they were made.

The auxiliary high-pressure fire service as installed in the City of San Francisco called for many considerations not ordinarily met with. The city is primarily one of hills and valleys, making the static pressure variations at different points on any long main very considerable. The possibility of earthquakes and the great danger of a rupture of the fire mains at a time when they would probably be needed most, imposed a multiplicity of points of supply for every district, so that in the event of any one or several being put out of commission, there would always remain a service that would be effective to deliver high-pressure streams independent of any pumping plant or portable steam fire engine.

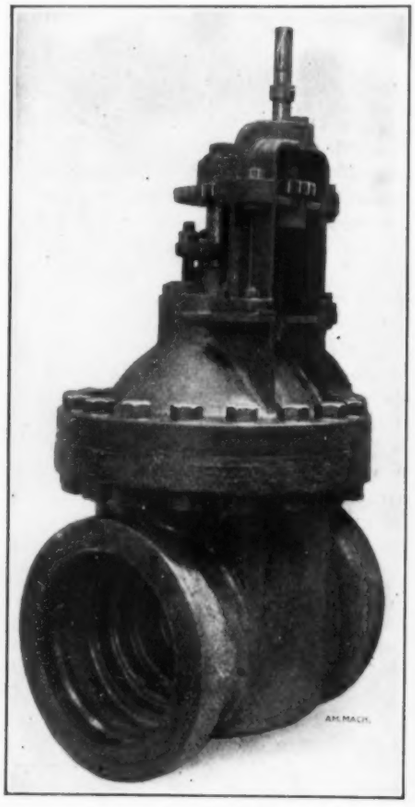


FIG. 1. THE TYPE OF VALVE USED

THE PLAN ADOPTED

The plan adopted provides, ultimately, about 100 cisterns located at high points about the city, from which a good gravity supply can be obtained in adjacent low localities; and these are all interconnected with a network of cast-iron pipe mains of large size working under a pressure of 325 lb. per square inch. Every fitting and pipe section was carefully tested to 650 lb. per square inch. All are put together with lead joints of special bell and spigot type, after elaborate tests to determine the best forms and dimensions, the fundamental requirement being a joint which would withstand expansion and contraction due to slight temperature changes, and to a reasonable shifting of the ground in long waves, without the introduction of severe structural strains in addition to those occasioned by the water pressure. No expansion joints are used.

THE WATER SUPPLY

The area covered by the high-pressure mains is considerably greater than that burned over by the conflagration of April 18, 1906. The mains are primarily fed from two reservoirs located on Twin Peaks, and these in turn feed to all the cisterns located throughout the city. These cisterns are normally full, but closed from the Twin Peaks reservoirs; thus each would serve as a considerable reservoir by itself, in the event of a rupture in the Twin Peaks mains.

Normal fresh water (to prevent the damaging corrosion which would occur if salt water were used constantly) is stored and instantly ready for service; but suitable pumping stations are located along the waterfront. Further than this, a number of fireboats with high-pressure turbine pumps can quickly be connected at a number of points on the waterfront to the pipe feeder system to reinforce the fresh water, should this be cut off by any accident, or should the needs of any conflagration exceed this fresh-water supply.

Further, this would be valuable should a large fire occur in the heart of the city, as the reduction in the friction loss when the mains are being used from all directions would result in the maintenance of the high pressure for at least twice as many high-pressure fire streams. Something over 3000 gate valves are being used in the distribution pipe network, and their reliability and simplicity are naturally among the most important factors of the entire design.

The 10-in. valve, Fig. 1, is characteristic of all the sizes, except that some of the larger sizes are provided with by-passes and with gearing.

MACHINING THE VALVES

The machining of the valve body was facilitated by the use of an indexing fixture which was fastened to the table of the Bullard boring mill as can be seen in Fig. 2. This consists of a substantial framework which carries the swinging cradle, this being tipped into position to receive the valve model which is being brought to it by the air-hoist on the left.

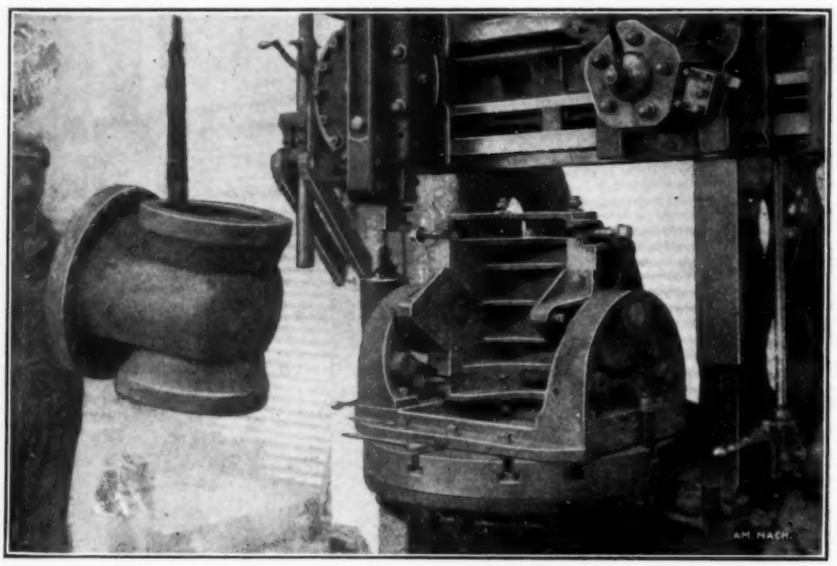


FIG. 2. THE FIXTURE AND THE VALVE BODY

How this is held in place by the semi-circular straps, which can also be seen, is shown in Fig. 3. The swinging of the cradle allows all three ends to be bored at the same setting, the indexing pin for locating these different positions can be seen in the illustrations.

The tool-head at the left in Fig. 3 is set to turn and face the flange, which

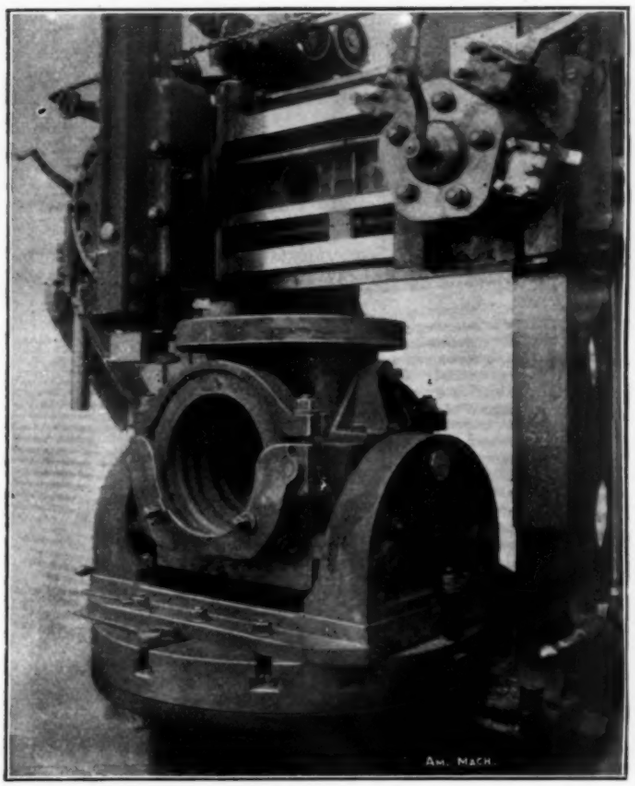


FIG. 3. VALVE BODY IN PLACE

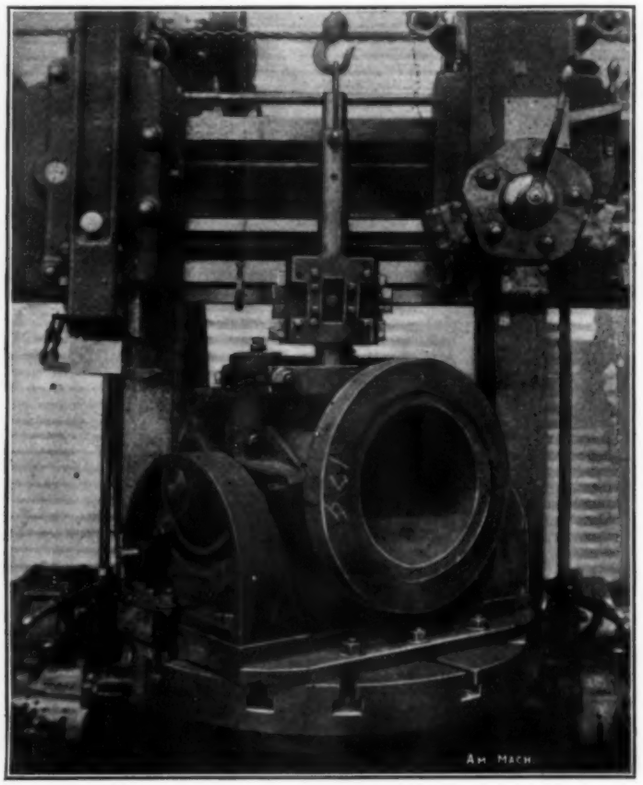


FIG. 4. PUTTING BORING BAR IN PLACE

FIG. 5. THE BONNET BEING DRILLED

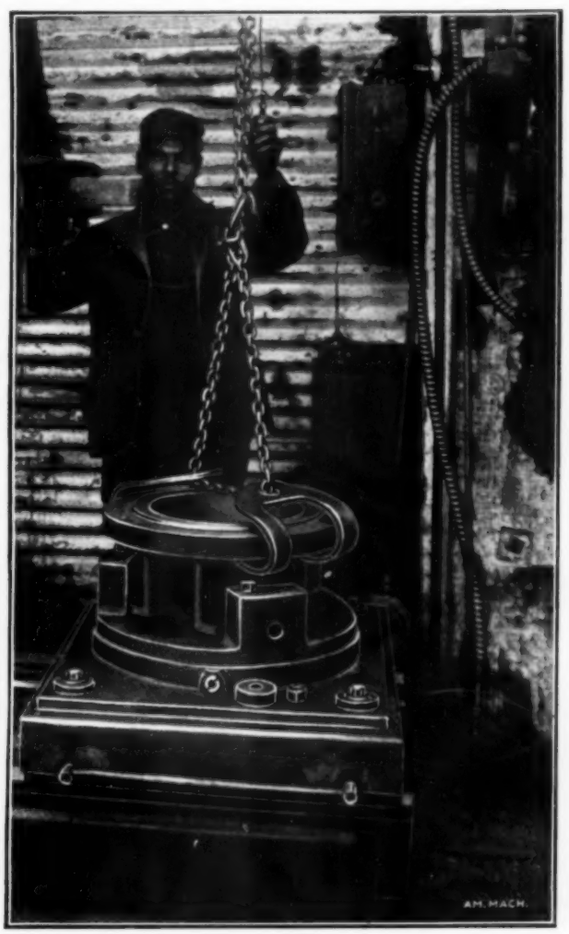


FIG. 6. HANDLING THE BONNET

receives the bonnet, and at the extreme left beyond this tool-head can be seen the end of the boring-bar which is supported on the wooden brackets which are fastened to the upright columns. This can also be seen even more plainly in Fig. 2. In Fig. 4 this boring-bar is being lowered into position so that the end will be guided by a bushing in the table,

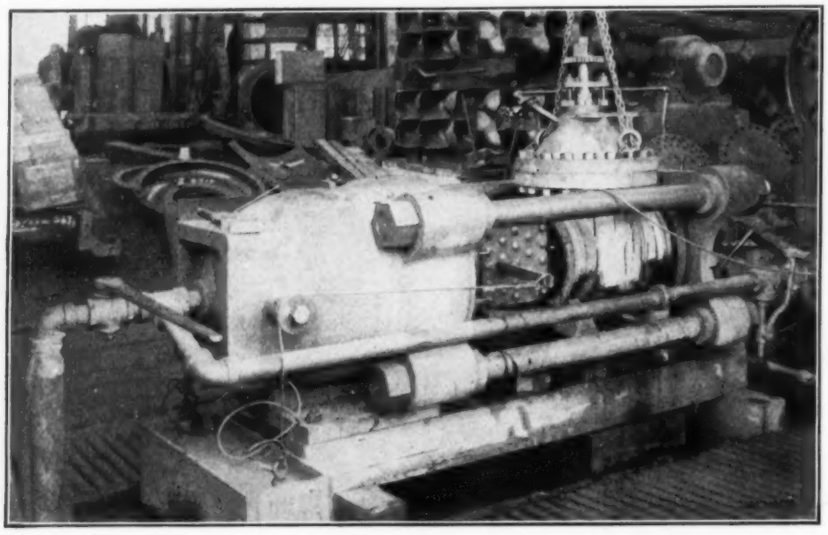


FIG. 7. MACHINE FOR TESTING VALVES TO 650 LB. PRESSURE

while the upper end is fastened in one of the turret holes.

In Figs. 5 and 6 the bonnet is being drilled on the Baush multiple-spindle driller, Fig. 6 showing how this is handled by the air hoist. Both views show the holding fixture for the bonnet and also the way in which it is slid along in the bed.

The gate set in place in the testing machine is seen in Fig. 7. Three tests up to 650 lb. per sq.in. were applied to each valve; first to the body and bonnet and then to each side of the disk. All of this was done at one setting by suitable pipe connections, and the end covers or plates were held in place against the rough casting ends with large soft gaskets in suitable faceplate grooves by the same hydraulic pressure applied through a ram of larger area than the valve.

A Veteran Employees' Association

BY ONE OF THE VETERANS

About 11 years ago, a group of employees, after their noonday lunch, were discussing the growth and development of the Westinghouse Air Brake Co. during its 30 years of existence, and speculating on developments during the next 35 years. These men had seen it grow from a very small beginning, and had watched with the keenest interest until it reached its then immense proportions, employing about 4000 men.

Someone suggested forming an association among the company's employees. The suggestion was acted upon at once, and a committee appointed to formulate a code by which the association should be governed. A meeting was called of the employees who had seen at least 21 years' service with the company, and an organization was effected with the customary officers and three trustees, all of whom had served at least 25 years. A code of simple rules was formulated and adopted to govern the association. All employees with 21 or more years' service to their credit were eligible to membership, but members of the association must have served at least 25 years before they could serve as officers in the association.

The object of the association was to cultivate a fraternal feeling among its members, and to keep a record of the members, also to hold an annual banquet and social hour, where members could meet and enjoy themselves in a social way. Usually this program consists of short speeches, instrumental and vocal music, interspersed with remarks from guests, among whom are the officials of the company. The membership embraces the heads of every department, including vice-presidents, general manager, secretary, treasurer, superintendents, foremen, as well as the everyday laborer.

At the annual banquet and social hour, there is no distinction between the executive board and workman. Business cares and shop troubles are sidetracked for the time and the officers and men meet and greet each other on terms of equality that do much to sustain the fellowship for which the company is noted. There has never been a ripple of discontent between the employees and the company. This may be accounted for on the theory that the employees' demands have been reasonable and have been presented to an executive body of fair and broad-minded men.

There has always been a noticeable disposition among the officers of the company to look after the welfare of employees, never sparing expense to meet that end. The employees appreciate these efforts fully. The shops are clean and comfortable, while the heating, ventilating and sanitary arrangements are all that could be desired.

In the record of men with long and active service credited to them are eight men with more than 40 years' service, five with 39 years, six with 38 years, forty with 30 years and fifty with more than 25 years' service. Vice-presidents, general manager, secretary, treasurer, superintendents, foremen, representatives, purchasing agent, etc., are all men who have grown up with the company and have merited promotion from the lathe, bench and clerical force.

The Veteran Employees' Association of the Westinghouse Air Brake Co. enjoys the unique position of being among the best organizations existing among industrial workers. The organization has been most beneficial, inasmuch as it has a tendency to bring officials and workmen to understand each other and mutualize their interests.

The most sanguine expectations have been realized by the organizers of the association, viz: Clayton Kaufman, deceased, Charles Highfield, deceased, E. B. Cushing, Thomas Campbell, James W. Smith, and Christopher Horrocks, 43 years' service. The association has about 250 active members still engaged in the works, and quite a few who have served the company faithfully and been retired with liberal life pensions.

A modification of tool sharpening by electrolytic etching, according to *Werkstattstechnik*, is possible if the tool is brought in contact with the electrolytic-acid solution at those places only which are to be etched off, instead of placing the whole tool into the acid solution. This is accomplished in the following way: A mold is made of porous calcined clay corresponding to the desired form of the metal to be etched, saturated with the etching solution and connected with the negative pole of a battery, then pressed with a slight pressure against the tool, which is connected to the positive pole. After a short time the mold electrode is removed, the tool brushed free of the solution, the mold electrode again dipped into a fresh acid solution, and again pressed against the tool. This method was used successfully by a large electrolytic engraving firm in Leipzig, Germany, to etch reliefs into metals.

Knurling Tools for Screw Machines

By S. Nevin Bacon

A variety of special tools for knurling in the automatic screw machine not commonly seen in regular practice.

The operation of knurling in the screw machine, turret lathe, etc., is in nearly all cases confined to ordinary work, which requires only the standard form of knurling tools, special knurls being rarely seen. Of course, there are in use many forms of the usual knurls, but the occasion seldom arises for tools of special design, the reason being that standard knurl tools are made with adjustments that cover a large variety of work.

Knurling a Spherical Piece

In Fig. 1 is shown a sample of work to be knurled. This piece was first knurled with the wide roller *A*, but the pressure was too great for the diameter *B*, so this method gave poor results.

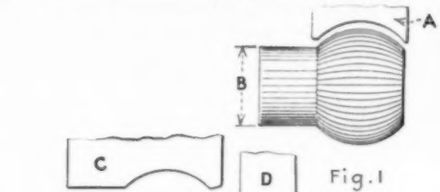


Fig. 1

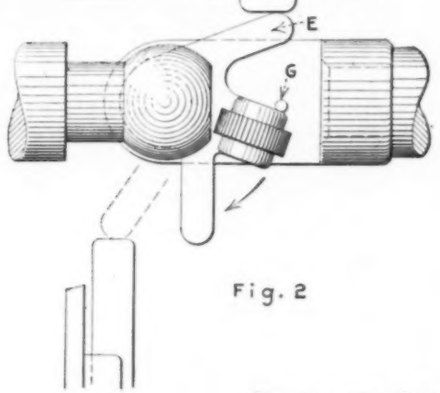


Fig. 2

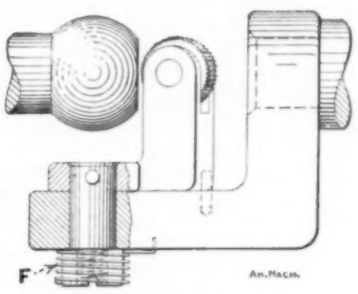


Fig. 3

Knurls for Spherical Work

Fig. 2 shows the improved method; the piece is first formed ball-shape by the form tool *C*, which is mounted on the back slide, which also carries the pusher *D*, operating the turning carrier *E*, which pivots on the pin shown in section. When the knurl has traveled part way around the ball, the pusher on the front slide operates it for the remainder of the arc.

The front view of this tool, in Fig. 3, shows spring *F*, which returns the knurl to position where it is stopped by pin *G*, Fig. 2. In operation the turret comes forward and the knurl roller is swung on its center by the pusher on the back slide, and after the front slide has pushed the knurl the remainder of the arc, the turret moves forward slightly, which allows the spring to return the tool as soon as the cross-slide drops back. It is necessary, of course, that the turret be held stationary in its forward position while the tool is working.

Cylindrical Knurling

A difference in operation is shown in Fig. 4, in that it is mounted on the front slide and operated by the turret. The work shown at *H* is seen at once to be too wide to knurl with one roller, and the flange prevents knurling from the turret. The block *A* is bolted to the cross-slide the same as any other tool post, and *B* slides in *A*, where it is operated by the pusher *C*. When the knurl has traveled the required distance, the cross-slide drops back and the turret is withdrawn, the lever *D* withdrawing the knurl. This lever is snapped into position by the flat spring when the turret is pushed forward.

This tool was used on a No. 2 Brown & Sharpe automatic screw machine, and the cams were made especially for the piece. The turret is withdrawn by a slow drop on the lead cam, and while dwelling here the front slide drops back before the turret is revolved, so that the knurl will not be pulled out of the holder. The spring and lever could have been dispensed with and a hook made solid with the pusher. In this case the turret would have to come forward first and dwell, the front slide then moving forward and the tool locating between points *E* and *G*.

A turret knurl, adjustable to different sizes of stock, the rolls being mounted on dovetailed sliding blocks, is shown in Fig. 5.

Internal Operations

A most interesting knurl is shown in Fig. 6. This knurl operates in three different-sized holes, thus combining the functions of three tools in one. The largest hole is knurled first. The holder *A* pivots on the screw *B*, and is operated by the cross-slide, the spring *C* withdrawing the knurl sufficiently to clear the smallest hole. In operation the turret comes forward and the guide *D* locates the depth of the knurl. When the front slide is withdrawn and the spring has caused the knurl to clear, the turret comes forward and this time the tool is guided by the step *D D*, and by the step *B B* when the smallest hole is knurled.

A distinct advantage with this tool is that there is no lost time in withdrawing

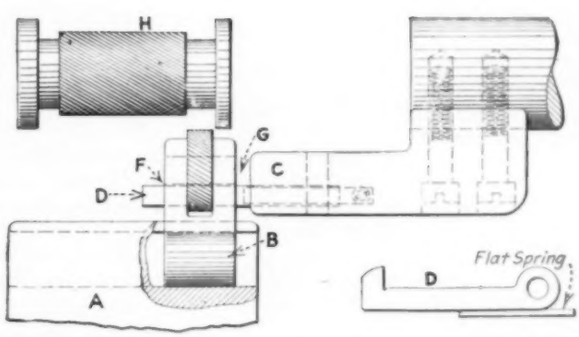


Fig. 4 Knurls for Cylindrical Work

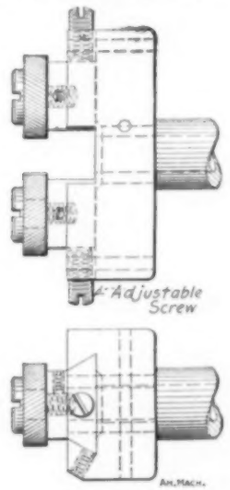
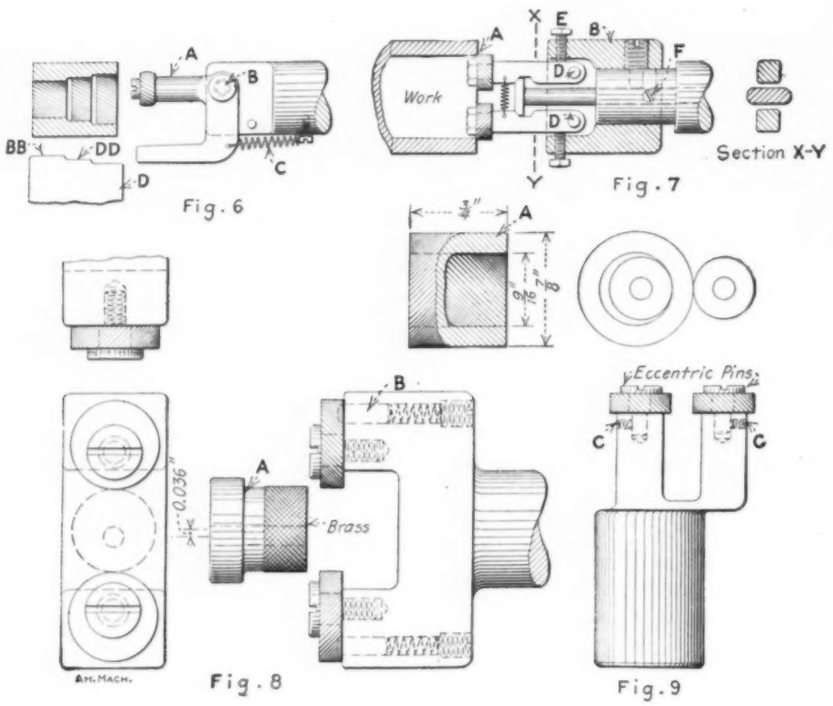


Fig. 5

the tool, as is usual with most turret knurls, which recut the knurled portion when they withdraw.

The same advantage is obtained with the inside knurl shown in Fig. 7, as this tool cuts only on the forward movement. When the tool advances to position, the teeth of the rollers stop against the end of the hole, as seen at *A*, and further movement causes the body *B* to slide back over the shank, to which it is connected by the pilot screw shown. As the tool is fed forward, the resistance of the knurls against the work causes the operating cam to push them in for the depth of cut by turning the levers on their pivots *D*.

When withdrawing from the hole, the spring pulls the levers toward each other, so that the teeth of the rollers are nearly out of the work, thus allowing very rapid withdrawal. When the correct adjustments are made with screws *E* and *F*, it is found that the knurling rolls scrape lightly when withdrawn from the hole, but not enough to cause trouble, as very little contact is necessary at *A* to cause the body to slide back and thus cause the rollers to bite into the stock.



ECCENTRIC AND COMBINATION KNURLS

KNURLING ECCENTRIC WORK

What is considered almost an impossibility is the knurling of eccentric stock from the turret. This is successfully accomplished on a Warner & Swasey hand screw machine by the tool shown in Fig. 8. The brass piece *A* is formed on the small diameter with an eccentric attachment. This is necessary in order to drill the hole and have it off center. When ready to knurl, the spindle is stopped and located in a certain position by a pin in the chuck cap in contact with the front cross-slide. The knurl rolls, which are set off center the same amount as the hole in the work, are revolved by hand until located by the plunger *B*.

It is now certain that the rolls will start correctly on the eccentric work, and the results are exactly the same as on concentric knurling. No adjustment is necessary for the distance between the center of the rolls, as this is taken care of by forming the diameter of the work to a size which suits the knurl, this diameter not being required to be held close. The plungers which locate the knurls are rounded on the ends to allow them to revolve when engaged with the work.

A COMBINATION TOOL

Having described some inside and outside knurling tools, consider the combination knurl, which successfully knurls inside and outside diameters simultaneously. A sample of work which was knurled in this manner is shown in Fig. 9. The knurl rollers are mounted on the holder shown, the shank of which is held in the turret. The adjustment for obtaining the depth of cut of the rolls is made by turning the eccentric pins (these are slotted but are not screws, as might be supposed), which are held in place by the headless screws *C*.

Accident Compensation Laws of California

SPECIAL CORRESPONDENCE

Former laws governing employers' liability in California have been largely amended through acts of the Legislature and the Governor during the past year. The new measures tend more fully to protect both employer and employee for injuries or death sustained by the latter in the fulfillment of duties, and the compensation to be derived. An Industrial Accident Board has been created to investigate all state industries, to settle all disputes which may arise through claims for injuries, and to completely carry out the provisions of the law.

At the last regular session of the Legislature, the initial employers' liability bill was introduced and passed, receiving the Governor's signature on April 8, 1911. The law provides as follows:

PROVISIONS OF THE INITIAL LAW

In any action to recover damages for personal injury sustained in the state by employees while engaged in their line of duty, the fact that such employees may be guilty of contributory negligence shall not bar a recovery therein, where his contributory negligence was slight and that of the employer was gross in comparison, but the damages may be diminished by the jury in proportion to the amount of negligence attributable to such employee. It shall be conclusively presumed that such employee was not guilty of contributory negligence in any case where the violation of any statute enacted for the safety of employees contributed to such employee's injury. It shall not be a defense (1) that employee either expressly or impliedly assumed any risk of the hazard complained of, and (2) that injury or death was caused in part or in whole by want of ordinary or reasonable care of a fellow servant. No contract, rule or regulation shall exempt the employer from the provisions of this section of the law.

Liability shall exist against the employer if, at the time of accident, employee is engaged in direct line of duty, or is performing service growing out of or incidental to his employment, and within the line of his duty or course of employment as such, or where injury is approximately caused by accident either with or without negligence and is not so caused by the willful misconduct of employee. Such liability shall include medical and surgical treatment, medicines, etc., during a period of disability not exceeding 90 days; the total liability for such service not to exceed $100. If the accident causes total disability, 65 per cent. of the average weekly earning shall be paid during such period; if it renders the employee not only incapable, but so helpless as to require a nurse, during such period of assistance, 100 per cent. of the average weekly earning. The aggregate disability indemnity for a single injury shall not exceed three times the average annual earnings of employee; if the disability is for not more than one week, no indemnity is recoverable; if for more than one week, no indemnity is recoverable for the first week of the period of

disability. The aggregate disability shall not in any event extend beyond 15 years from the date of accident.

Death shall be deemed the termination of disability and the employee is liable for the following death benefits: If the deceased leave person or persons wholly dependent upon him for support, the compensation shall be a sum sufficient, when added to the benefits which shall have accrued at the time of death and become payable, for a total compensation for death and injury equal to three times the annual average earnings, not less than $1000 nor more than $5000, payable in weekly installments corresponding to the amount of weekly earnings. If the deceased leave no one wholly dependent upon him for support, but one or more partially dependent, it shall be a percentage of three times such annual earnings of employee as annual amount so devoted by the deceased, payable weekly; such sum shall not exceed three times the average annual earnings. If the accident cause permanent disability, total or partial, and the employee die within 15 years after date of accident and leave no one dependent, the employer must bear funeral expenses, such not to exceed $100.

The average weekly earnings shall equal one-fifty-second of the average annual earnings, which shall be taken as not less than $333.33 nor more than $1666.66. If employee has worked for a year, at the time of accident, average annual earnings shall equal 300 times the average daily salary; if he has not worked for such period, the average annual earnings are to be taken at 300 times the average wage of employee of the same class. Where the employee may have received a previous disability or received compensation therefor, this shall not preclude him from compensation for a later injury or for death resulting therefrom. Where a weekly loss of wages is to be considered it shall equal the difference between the average weekly earnings of employee before injury and the weekly amount that employee is capable of earning after such injury. Examination or examinations of employee, during period of disability, are to be made by a physician paid for by the employer, and also by a regular physician employed by the Industrial Accident Board. The law applies to the entire state, to all industries and to all employers, whether individuals, partnerships, corporations or the like.

The Industrial Accident Board

The Industrial Accident Board created by this legislative act consists of three members, appointed by the Governor with the advice of the Senate. The board comprises one member appointed for 2 years, one for 3 years and one for 4 years, and thereafterward to be appointed for terms of 4 years each. The annual salary for each member is placed at $3600, with any traveling expenses incurred while engaged in work in addition. The board may adopt its own rules of procedure, changing such at its discretion, and may employ expert examiners, a secretary and clerical help. The office of the board is at San Francisco.

A hearing is to be given by the board within not more than 40 days after the filing of application. The board may take expert testimony, inspect scene of accident without notice to either party concerned, examine time-books or payroll of employer, and appoint a physician to examine employee. The board shall file (1) its findings of facts, and (2) its award, with determination as to rights of party. The award is to be presented to the Superior Court and such court shall without notice render judgment, the same as though the case had been tried. The party may appeal from the judgment rendered by the court on the report of the board, and have the case placed on the calendar of the Superior Court if the grounds for such review are (1) that the board acted without or in excess of powers, (2) that the award was procured by fraud, (3) that the findings of facts of the board do not support its awards. In absence of any fraud, the action of the board shall be conclusive.

The bill further provides that all claims for compensation shall come before any debts of the employer; that the sum of $50,000 is to be appropriated to be used by the Industrial Accident Board for the fulfillment of the act.

At a special election, Oct. 10, 1911, a Senate amendment (No. 32) to the state constitution, adding a new section relating to compensation for industrial accidents, was passed by a vote of the people. The primary object of the amendment is for the enactment of a compensation law that may be compulsory on all employers, reducing the range of compensation to certain amounts by abolishing court litigation and jury verdicts, and providing for immediate pecuniary relief to the injured employee. The amendatory section provides as follows:

The legislature may by appropriate legislation create and enforce a liability on the part of all employers to compensate their employees for any injury incurred in the course of the employee's occupation irrespective of the fault of either party. The legislature may provide for the settlement of any dispute arising under such legislation by arbitration, or by an Industrial Accident Board, by the courts, or by either any or all of these agencies, anything in this constitution to the contrary notwithstanding.

Extension of the Board's Powers

At a special session of the Legislature, December, 1911, three bills were introduced and passed. The acts provided extended powers to the Industrial Accident Board, and affirm a time limit on the filing of accident reports. They are as follows:

The Industrial Accident Board is authorized to gather statistics of all industries in the state, relating to personal injury, accidents and the like. Employers must assist the board in the collecting of such data, and upon refusal to so aid become liable to a penalty of fine or imprisonment. The board is prohibited from making public any of its findings. The sum of $15,000, from the general appropriation of $50,000, is allowed the board expressly for the purpose of fully furthering the provisions of this act. An amendatory section exempts poultrymen, dairymen, horticulturists, and those engaged in similar occupations, from its jurisdiction.

Employers must file a full report of accident with the Industrial Accident Board within 15 days of date of happening. Such report requires the name of employer, locality of place of employment, name, address, age, nationality, sex and occupation of injured employee, length of time injured employee had worked at such employment previous to injury, date and hour of day or night of accident, hour at which the employee began work on the date of the accident, nature of the injury, cause of injury, and rate of wages of the employee. The employee must file a supplemental report as to claims and settlements for injuries sustained. Physicians and insurance companies are required to file reports. Failure of the employer to submit a report within the time specified makes him liable to a penalty of fine or imprisonment. The records so obtained by the board are to be preserved for the framing of laws, upon statistics, of indemnity and insurance.

Inter-insurance associations may be formed by employers, whether individuals, partnerships, corporations, or the like, for coöperative insurance against the indemnity claims of injured employees. A license fee must be remitted for such exchange. Employers may associate among themselves in contributing funds for the benefit of injured employees.

Don't Clog Up the Grinding Wheels

By L. T. Coddington

Have you any flat or square India oilstones or carborundum sticks which are all furrowed and worn, or glazed over so that they won't cut? You can put them in first-class condition in a few minutes by a very simple process.

Get some loose emery from the polishing room—No. 70 or 80 works well or any grade coarser than the grade of the stone to be dressed. Sprinkle it on a flat, iron bench block and rub the stone over it with a straight lengthwise motion if it is a narrow stone or a circular motion if it is broad enough not to tip or rock. Repeat this until nicks and creases are worked out, and then clean with kerosene and a brush. A good, true surface is thus obtained.

If you want a square corner or any particular beveled edge on the stone you can get it by just bearing a little harder on one side or tipping the stone at the proper angle when you are dressing it.

If you try to grind it flat on an emery wheel, you will find that it will clog the wheel and the stone too. But the loose emery will roll under the stone and present new sharp edges to the work and therefore cut faster.

In casting brass, be sure that the crucible is dry and thoroughly annealed before putting it in the furnace.

Machinery Salesmen for Latin-America

By Archibald J. Wolfe

The essential qualifications of a successful salesman for South American trade, and a few of the important considerations in traveling.

As the commercial and industrial possibilities of Latin-American countries are steadily inviting the competition of American manufacturers, and as these manufacturers are bidding for this trade largely through their traveling representatives, it is the purpose of this article to set forth the material and mental equipment necessary to successfully cope with the strange conditions that confront the uninitiated salesman in this quarter of the globe.

In the first instance, a wise manufacturer will not send a salesman to Latin-American countries who cannot speak the languages current there—Spanish for all countries but Hayti and Brazil, Portuguese for Brazil. Hayti (where French is the current language) may be well left out of consideration in this connection. Spanish is absolutely necessary, for at a pinch one may get through with Spanish, but without Portuguese in Brazil. To get the best results, the traveling salesman must have the best equipment, and therefore it is better to send to Brazil and to other Latin-American countries men who thoroughly know the land, its customs and its language. To send a man unacquainted with the language of the land is equivalent to employing deaf and dumb salesmen in a department store.

There is only one condition under which a house may send a representative to Latin-America without a knowledge of the language, and that is on a mission merely for education and information to be used later in the home office. But even so, a smattering, at least, of Spanish will not harm. Languages can be learned so easily by modern methods that it is an unnecessary handicap to go without this equipment even on a sightseeing trip abroad.

It is only on rare occasions that a trip covering all Latin-American countries is contemplated. It is best to make several trips, first to the near-by markets, Mexico, Cuba and Porto Rico. We may consider Porto Rico in this connection still as an export market. Then if the goods are salable in Central America, a trip to the Central American states—Guatemala, Costa Rica, Salvador, Nicaragua, Honduras. Then Panama, the connecting link between Central and South America, may be undertaken.

If the Central American states are not buyers of the class of machinery built by the manufacturer, his salesman may still go to Panama and work down the west coast—Ecuador, Peru, Bolivia and Chile and make his way to the River Plate countries—Argentina, Uruguay and Paraguay. The last named republic may be omitted from the itinerary unless the trip is intended to be very thorough. Or the salesman may take a trip to Brazil, from there to Argentina, and work his way up the west coast northward and thence over the Isthmus of Panama home.

Needs of the Itinerary

The first thing in arranging a trip to these countries is to fix up a suitable itinerary. This will include all countries where the trade is to be canvassed, omitting those countries where the goods sold by the manufacturer have no market. It is a waste of time and money to push nail-mill machinery in Honduras or high-speed turret lathes in Paraguay.

The arrangement of the itinerary will then be based upon the information as to the demand in each locality for the machinery built by the manufacturer in question. The industries of each country will be studied, the statistics of exports of the class of machinery concerned will be examined, and if possible the activities of the competing manufacturers of the United Kingdom, Germany, and perhaps France will be ascertained.

After having equipped himself with a knowledge of Spanish and Portuguese, and studied the possibilities of each market for the goods represented by him, the traveling salesman may have the idea that he has gone to a great deal of trouble and labor in undertaking his mission. He may ponder a little over the fact that in doing all this studying and preparing, he has endeavored merely to approximate the equipment of a domestic salesman trying to sell his goods in the home market. The domestic salesman would not dream of approaching his Detroit customer in Pennsylvania Dutch, if he wanted to sell him a screw-cutting machine, and he will certainly inform himself of chances to sell machine tools before invading a territory. He will not canvass for machine-tool buyers in the moonshine districts of Kentucky or in the summer-resort sections of New Jersey.

Need of a Knowledge of the Country

The next step is to study good books written by recent travelers on the living conditions, customs and history of each land scheduled for a visit. Of late years there has been a vast crop of highly-interesting, readably-written books by travelers in Latin-America, and the prospective traveler will find here and there in these a hint that may save him a great deal of money, labor, humiliation, and heartburning.

It will also add to his fund of information, for as a nation we are rather deficient in the geography, history, customs and lives of our Southern neighbors. It will not hurt a traveling salesman to know who Simon Bolivar was, or when Brazil became a republic; it will not hurt him to imbibe any knowledge available concerning the countries he intends to visit—not if he means to render himself an efficient employee in a new field.

With regard to material equipment, he will read up on the climate of the countries to be visited and will not burden himself with winter clothing. At Buenos Aires and Valparaiso warm clothing is a not unnecessary item. It is best to provide clothing such as one would wear in warm weather in the United States. It is customary to dress for dinner on board the South American steamers, but in the daytime duck suits, negligee shirts and low tennis shoes are in order. Bathrobe and slippers are a necessity, there being no private baths in most of the hotels encountered.

Climatic and other Requirements

In arranging for a trip the traveler will learn that when we are in the midst of summer in New York, there is winter in Argentina—the seasons are reversed. In the tropical countries, of course, there is no change of season. If the place he visits is very high up, the climate there is cooler. Instead of speaking of cold and hot periods in the tropical countries the seasons are dry and wet. It is advisable to refrain from trips to the West Indies from July to September inclusive, this being the season of violent hurricanes, and a dangerous and very uncomfortable time of travel.

The next step is to select the best steamship line. This is a comparatively easy task, due to the fact that most of the lines catering for the passenger traffic from New York to Latin-American points are good, and a visit to the various ticket offices in New York City will help the individual to choose in accordance with his own tastes and preferences.

Baggage is another important item. In the case of a salesman handling machinery, samples, of course, are not practicable. But the salesman may wish to carry models, or to show smaller machines in operation. If this is considered advisable, then he will consult a firm of forwarding agents and arrange

for the shipment of the models to coincide with his own travels from point to point. It must be admitted that such a plan is somewhat difficult of execution. It is better to have the machines consigned to some machinery house on the spot if ocular demonstration is absolutely necessary. But with regard to personal baggage a steamer trunk fitting under the lower berth is a necessity. Other pieces of baggage, preferably small, because of transfer on rowboats in various ports, will be held in a storeroom or in the hold. All should be plainly marked. Before departing the traveling salesman will secure a passport from Washington, a very simple proceeding, but a very necessary precaution. The cost of this is one dollar.

With regard to money it is well to carry enough American money for emergencies on board ship, and a letter of credit for the rest. This can be secured through any bank. In addition to the letter of credit, it is always well to have $20 to $40 in gold in the pocket, for the reason that frequently the local bank will be closed because of some holiday, and it may be necessary to make a quick move to catch a certain steamer.

CUSTOMS REGULATIONS AND TAXES

In traveling through these countries the salesman will find that each country has customs officials who will examine his baggage. There are regulations governing the admission of samples and models into each country and generally providing for the return of any duties paid out for them, when the goods are reexported. These regulations may be properly considered in articles dealing with the individual countries.

In most of the countries there are taxes leviable on traveling salesmen actually soliciting orders. These taxes may be national, state or municipal taxes. In some municipalities, as for instance in many throughout Brazil, these taxes are quite heavy, but on the other hand in various places in that republic these heavy taxes are not enforced.

These regulations are too numerous to enter into the limits of this article, but they are described in a handy little volume entitled "Regulations for Commercial Travelers," published by the Department of Commerce and Labor. The pamphlet may be had for the asking and contains this information in concise form. With regard to any deterrent effect of these regulations it may be said that salesmen of all nationalities are supposed to submit to them, and where they are annoyingly irksome, it will be found that they are not rigidly enforced.

What kind of hotels will the traveling salesman find in Latin-America? Very good accommodations in the large cities, and poorer quarters in the minor sections. Even in the larger cities there is a vast difference between the hotels. It is best to stick to those patronized by English-speaking people. These can be ascertained on board ship. The rates are from $3 to $5 per day American plan.

A SUGGESTION AS TO POINT OF BEGINNING

It has been recommended that the traveler who wishes to cover South America go first over Panama down to the west coast, as suggested previously. The reason for this preference is that the traveler has on such a trip the chance of gradually meeting with various Latin-American nations and accustoming himself to their habits and ways of doing things. The steamship connections for getting from port to port will be found better on the west coast.

The traveling salesman is advised to agree upon a telegraphic code, or to prepare a private code for use between himself and his home office. Letters should never be addressed in care of hotels or general delivery, but always in care of the American consulate wherever there is such a consulate, or in care of the bank to which a letter of credit will be presented. In this case it is well to notify the bank of the possibility of mail arriving for the traveler.

Connections between railways and steamships all along will be found exasperatingly inconvenient. It may often happen that the traveling salesman is in a certain town from which there are two trains a day, perhaps only one train a day to the coast. To assume that the steamship leaving the coast port on the afternoon of that day will wait for the train is fatal. More often than not the train will steam into the shed just in time to see the smoke of the steamer curling gracefully on the horizon.

The traveler will learn to take nothing for granted, but to find out things for himself; not to hurry, but to be patient; not to rush the Latin-American, but to fall in with his ways and to humor him. After a trip or two, if he has any knack of adapting himself to his surroundings the salesman will find it easy sailing. He will find charming people with whom it is pleasure to do business in the way in which they care to have business done. Incidentally he will rearrange and revise his somewhat hazy ideas on things Latin-American in general, and finally all these educational preliminaries will be reflected in the sales of the machinery manufactured by his employers.

Sketches vs. Written Information

BY E. W. TATE

How many manufacturers and purchasing agents take into consideration the delay and annoyance caused when ordering repair parts for a machine by giving a written description of the part wanted instead of inclosing a free-hand sketch?

For example, repair parts for an engine lathe are wanted. One order will state that the purchaser will want a 14- or 16-tooth gear for the apron-feed works. Perhaps there are two or more gears of that number of teeth in the apron. He may state the face of the gear and also the size of the hole. There may be more than one gear in the apron that answers these descriptions, but one may be forced onto a shaft while the other may run loose on its bearing, or may have a shoulder which is forced into the hole of a larger gear. One may be slotted for a key only part way through.

From these examples it will be seen that it is quite impossible to write all the information desired by the manufacturer. And it would only take a few minutes to make a free-hand sketch of the part wanted, while it may take considerable time for the manufacturer to decide just what part is wanted, and then there is always the possibility of a mistake, for all of which the purchaser has to pay.

Cutting Double, Triple or Quadruple Threads

A double thread is desired, 4 threads per inch. Turn the compound rest to 90 deg. (or in line with the bed); proceed as with any other thread with the lathe geared for 4 threads until almost deep enough, then move the compound ⅛ in. —or 0.125 in. if the screw is graduated —and cut to same graduation on the crossfeed screw as on the first one. You can then see how easy it is to change the tool for each cut—thereby keeping both threads the same depth and size.

This rule will apply to any thread, and where a good compound rest with graduations on the screw is available it cannot be beat. It is easy to divide the thread in thousandths as follows: 1 in. = 4 threads, 1 thread = ¼ of 1 in., or 0.250; two threads are wanted in the space of one, so half of 0.250 = 0.125.

The earliest use of peat was for fuel, and dates back to the dawn of history. Latin authors of the time of the conquest of Northern and Western Europe by the Romans commented on the miserable condition of some of the people of those regions, who dug the soil from their marsh lands with their hands, and, after drying it, burned it to warm themselves and cook their food. In Ireland, of necessity, peat has been the only domestic fuel of the mass of the people from the traditional time when the forests of that country were finally almost cleared away. Scarcely less ancient is the use of peat for fuel in other parts of Northern Europe—Holland, Germany, Russia and parts of France and Austria. The disappearance of the forests at a comparatively early period, while agriculture was the most important industry of these countries, led to the widespread use of peat fuel, especially by the poorer classes of people.

The Plant Behind Cincinnati Millers

By L. P. Alford

The Oakley development as a whole, and details of the shop of the Cincinnati Milling Machine Co. This is a combination of a three-storied concrete structure and a single-story, saw-tooth roofed building.

There are numerous interesting details of construction and equipment.

Any description of the new shop of the Cincinnati Milling Machine Co., Cincinnati, Ohio, must begin with the Oakley development as a whole. To Fred A. Geier, president of that company, belongs the credit of projecting and carrying through the broad scheme which has made possible the machine-building colony known as the Columbia Road Shops, at Oakley, a suburb of Cincinnati.

In 1906, 102 acres of farming lands were purchased by the Factory Colony Co. This tract lay along the west side of Columbia Road and adjacent to the tracks of the Baltimore & Ohio Ry. The original project included plans for three machine shops, in addition to the one of the Cincinnati Milling Machine Co., a gray-iron foundry and a common power house.

The first buildings erected were the foundry of the Modern Foundry Co. and the power house. The foundry is owned by the stockholders of the milling machine company, and is fully equipped with modern foundry appliances. This plant was erected in 1907. Following this came the first section of the milling machine company's shop.

The power house is owned jointly by the companies whose plants it serves. The four original firms are: The Cincinnati Milling Machine Co., the Cincinnati Bickford Tool Co., the Cincinnati Planer Co., and the Triumph Electric Co. Recently plants have been built by the Cincinnati Lathe & Tool Co. and the Alvey-Ferguson Co., making in all, including the foundry and power house, eight factory developments.

Co-operative Power House

The coöperative power plant is housed in a brick building with a steel-framed wooden roof, and is divided into the boiler room, engine room, heater room and a small adjacent room for the underwriters' fire pump. Provision has been made for future growth. The boilers are of the water-tube type with an aggregate capacity of 1800 hp. Electric current is generated by direct-connected, horizontal,

Fig. 1. Setting-up Bay, Showing Type of Saw-tooth Construction

cross-compound, noncondensing steam-engine units, aggregating 1500 kw. in rating. In this room there are also two air compressors, having a combined capacity of 3000 cu.ft. of free air per minute.

The heating apparatus which supplies heat for all the factory buildings, is for an Evans-Almirall hot-water, forced-circulation system.

Service water for drinking, sanitary and all other purposes is pumped from a driven well by means of an air lift. An auxiliary supply of city water is also available. Near the house is an artificial reservoir with a capacity of 250,000 gal., serving as a supply for the fire pump. An elevated steel tank holding 75,000 gal. furnishes a gravity supply for the wet sprinkler service. Supported by the same steel tower that carries this sprinkler service tank and placed below it, is a smaller tank, having a capacity of 50,000 gal., providing a gravity supply of service water.

The power house is connected with all of the shops by means of concrete tunnels. Through these tunnels are supplied to all of the shops 220-volt, direct-electric current for power and lighting, compressed air at 100 lb. pressure per sq.in., hot water for heating under a pressure of about 30 lb., service water under a pressure of 35 lb., and water for the sprinkler system, when needed, under a pressure of 65 lb. The temperature of the water for heating in severe weather is about 205 deg. F. when it leaves the power house and about 180 deg. F. when it returns. This initial temperature can be regulated, depending upon the weather conditions. Under ordinary conditions of running, there is sufficient exhaust steam to heat all the water needed to warm all of the buildings. The plant is so arranged, however, that live steam can be turned into an auxiliary heater to increase the temperature of the hot water in case there is not enough available from the exhaust-steam heaters, also to supply hot water for night and Sunday requirements.

The driven wells supply the boiler-feed water, which is passed through a purifier and softener before being used. The condensed exhaust steam, after passing through the hot-water heaters, is discharged into an open feed-water heater, thus furnishing the greater part of the boiler supply.

The coal supply is dumped from hopper cars into a large bin beneath the railroad track. Thence it is conveyed to the top of the building by a bucket conveyor, thence by a spiral conveyor to the individual hoppers of the boilers. The combined storage capacity is 800 tons.

Each of the companies served from the power house is charged for current on a kilowatt basis, and according to a sliding scale of quantity.

All of the compressed air and service water are metered and paid for at so much per 100 cu.ft. Heat is paid for on a unit basis per square foot of radiation per month. The sprinkler service is paid for on the basis of a rate per sprinkler head.

Especial attention should be called to the fact that all of the buildings at Oakley are equipped with sprinklers, and in this and all other particulars, fully meet the requirements of the mutual fire insurance companies, in which the plants are insured.

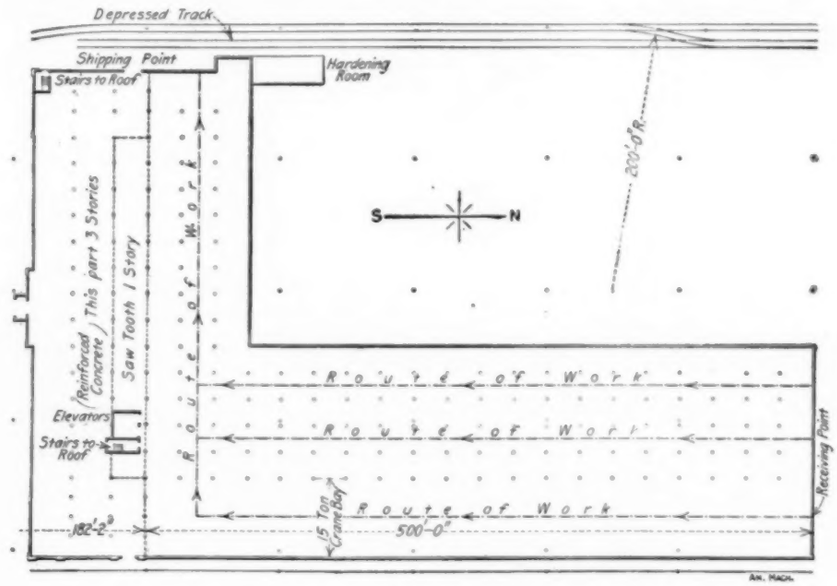


FIG. 2. GENERAL PLAN OF SHOP, SHOWING ROUTE OF WORK

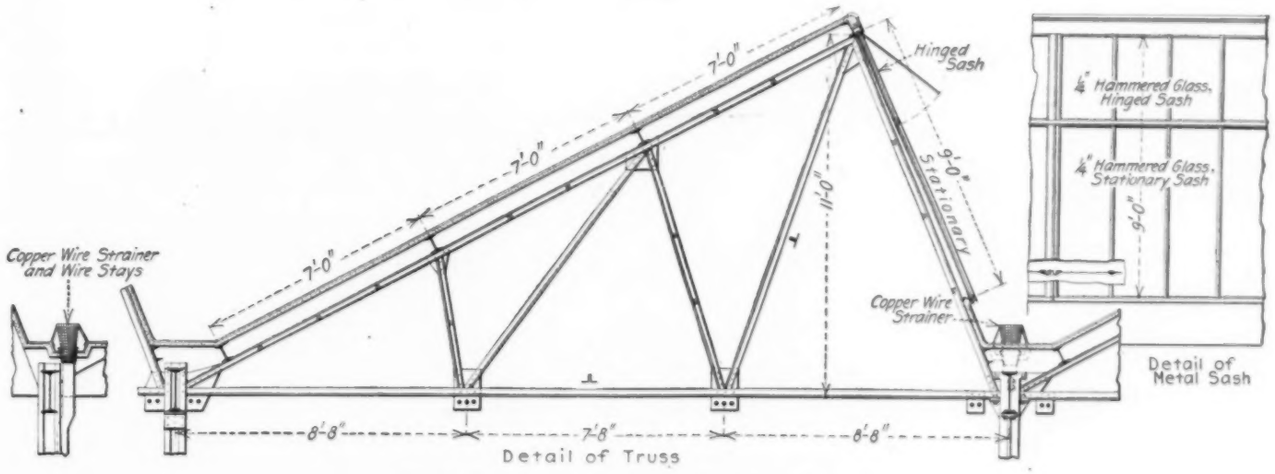


FIG. 3. DETAIL OF SAW-TOOTH TRUSS AND GLASS

GENERAL LAYOUT OF THE PLANT

The plant consists of a three-story concrete section, averaging 60 ft. wide and 380 ft. long, added in 1911 to the machine shop proper, which is a building of saw-toothed construction, having an L-shape on the ground, the main portion being 525 ft. long by 163 ft. wide, the other 217 ft. long by 75 ft. wide. The ground floor is continuous throughout both the three-story and one-story section, thus forming an unbroken L-shaped space. An interior view of this narrower part of the

saw-toothed building is shown in Fig. 1. A general ground plan is shown in Fig. 2. On this has been indicated the route of the work through the shop. At the end of the larger leg of the saw-toothed building all of the raw material is received. This end is opposite the foundry whence the castings are received, also a spur track where all other raw material is unloaded.

FIG. 4. PLANER DEPARTMENT, SHOWING ARRANGEMENT OF CRANE GIRDERS

The route of this material is lengthwise of the shop, the large castings along one side and the small castings, and bar stock along the other. These streams of raw material are machined as they pass forward and finally unite in the area under the 75-ft. saw-tooth roofed section where they are completely assembled and finally pass to its end for shipment as completed machines. Across this end is a depressed spur track flanked by a concrete loading platform of the height of a freight-car floor.

The three-story concrete section is monolithic, with a large glass area in the side walls, faced on the front with red brick and white artificial-stone trimmings in keeping with the construction of the plant. The floors throughout are of concrete. In this section of the building are made cutter grinders and miller attachments. In the eastern end of the first floor is provided a large service room immediately accessible from a separate employee's entrance. A portion of the second floor is used for the storage of finished parts; the third floor is taken up by the assembly hall, executive offices, engineering department and tool-making room. The floors of the engineering department and offices are covered with ceramic tile. The partitions are fire-resisting asbestos blocks, plastered to give a pleasing finish and fitted at the bottom with a sanitary tile base. The trim of these rooms is hardwood with a dark old English finish.

THE SAW-TOOTHED BUILDING

The saw-toothed section was erected in 1909 and 1910. It is used exclusively for the building of millers. Figs. 1 and 4 show two departments located in this building and give an excellent idea of its general construction. Fig. 3 is a detail of one of the trusses of the roof showing the proportion of glass, the way in which it is set and the operation of the ventilating device. The sash is metal.

The proportions of this truss and the arrangement of the glass were fixed to meet the conditions of light in the latitude of Cincinnati. The glass area, of course, faces the north.

An interesting detail of this roof construction is the absence of longitudinal girders to support the individual saw-toothed trusses. The trusses themselves are tied together and braced to give a girder effect on the steeper face. They are also tied together on the other face to give stiffness and prevent buckling.

The roof itself is of reinforced concrete (High Rib) and is covered with a tar composition.

One bay is shown in Fig. 4 in which the large castings are machined. It is flanked by steel columns serving the double purpose of supporting the roof and carrying the girders for the traveling crane. The other interior columns are of cast iron.

The roof drainage is taken down through these hollow cast-iron columns and through downspouts alongside the steel columns. These drainage points are fixed 40 ft. apart along the gutters, this being a low point to which the water is drained for a distance of 20 ft. on each side.

The exterior walls of this part of the shop are of red brick trimmed on the sides facing the street with white artificial stone. On the inside the wall is faced with white brick to do away with

FIG. 5. ARRANGEMENT OF CRANE AND HOISTS IN SCRAPING AND HEAVY-MACHINE DEPARTMENTS

the necessity of frequent whitewashing or painting.

The floor is a continuous reinforced-concrete slab 8 inches thick, laid on tarred paper in contact with the soil. The top of this floor for a depth of one inch is a wearing surface composed of a rich concrete mixture. Owing to the controversy over the use of concrete floors in machine shops, it is interesting to note that in this plant they have proved satisfactory. The floor is of such a thickness that it forms an excellent foundation for the machine tools, jib cranes and other parts of the equipment that must be bolted in place. It also provides the essential stability for the assembling and testing department. On the score of the workmen only three complaints have been made and oddly enough one of these came from a crane tender. The men are allowed to use wooden gratings at their machines if they so desire.

FIG. 6. DETAIL VIEW OF HOISTS IN SCRAPING DEPARTMENT

THE HEATING EQUIPMENT

The heating equipment of the shop consists of pipe coils running around the exterior walls beneath the windows and overhead along both sides of each roof gutter. The latter arrangement overcomes the discomfort which usually results in buildings of this type, from cold-air currents descending from the roof windows. These can be plainly seen in Figs. 1 and 4. In the offices and drawing rooms cast-iron radiators are used instead of pipe coils. The heating factor is one square foot of exterior heating surface for each 132 cu.ft. of room volume. As stated in mentioning the power house, hot water is circulated under a pressure of about 30 lb. per square inch. This system has proved very satisfactory in use, and as there is ample exhaust steam under most weather conditions it is considered a very economical system to operate. The distribution and amount of radiation has proved sufficient in even the most severe weather of the present winter. Continuous temperature records are kept by means of recording thermometers placed at various points in the building.

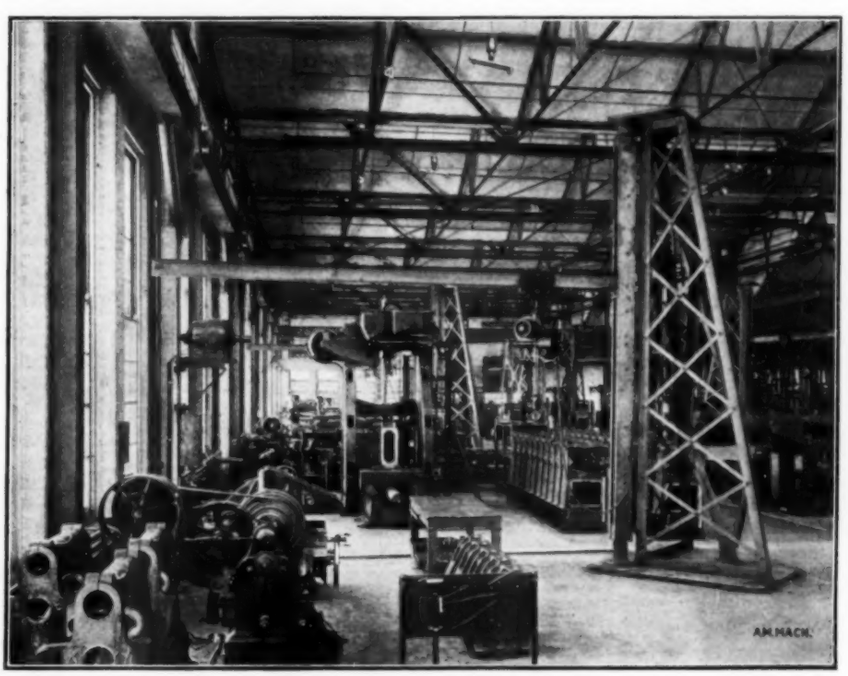


FIG. 7. DETAIL VIEW OF A JIB CRANE IN THE BORING DEPARTMENT

PROVISIONS FOR VENTILATING

The ventilation of the single-storied shop is through the saw tooth. The upper row of lights is hinged at the top and swings outward at the bottom. The relative areas are such that 60 sq.ft. of glass can be swung outward for each 500 sq.ft. of floor surface beneath. All of the movable sashes for the full length of a saw tooth are operated from a single point at one end. It will be readily appreciated that the degree of ventilation that can be had through this large opening is much greater than that afforded by the usual ventilators provided in such roofs, on the basis of one 48-inch ventilator for each 100-ft. lengthwise section of roof.

NATURAL AND ARTIFICIAL LIGHTING

Natural light is admitted not only through the glass area in the roof but also through windows in the side walls. In the roof there are 180 sq.ft. of glass for every 500 sq.ft. of floor area below. Further 65 per cent. of the area of the side walls is glass. The glass in the roof and along the walls having an eastern and southern exposure is hammered to cut down the glare of sunlight. The rest of the glass in the sidewalls is clear.

The artificial lighting of all parts of the shop except the offices and drawing room is by means of 110-volt, direct-current, Cooper-Hewitt mercury vapor lamps. These are tapped, two in series, from the regular 220-volt mains. Each unit has a rating of 385 watts and in general is used to illuminate a floor area of 500 square feet.

The artificial lighting in the offices and drawing room is from 110-volt, 100-watt tungsten filament lamps. This lighting is indirect; that is, the light is thrown against the white ceiling and reflected

therefrom upon the desks and tables below. This entire installation is a good example of the use of modern, high-efficiency lighting units.

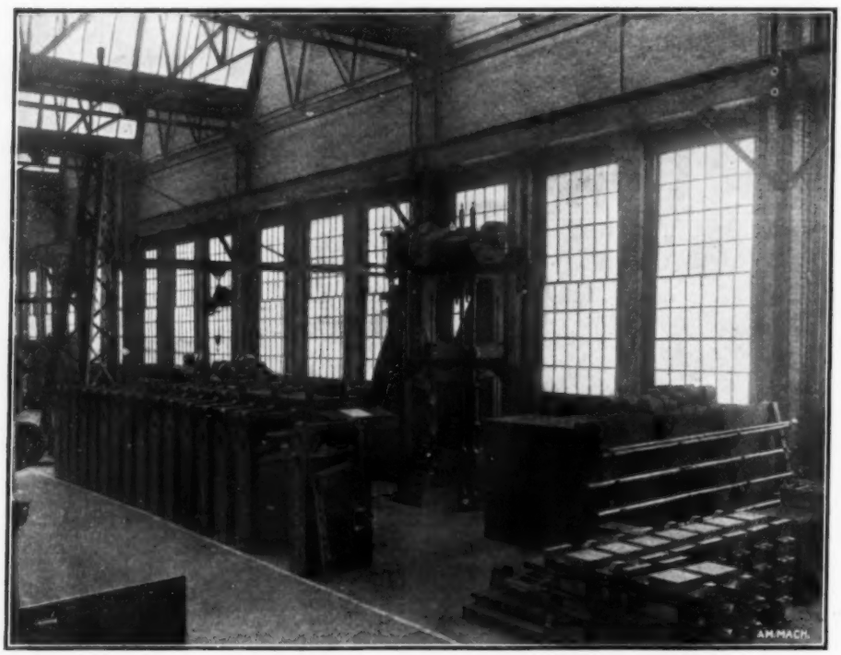


FIG. 8. A SPECIAL BORING MACHINE

THE SANITARY EQUIPMENT

The sanitary equipment of this plant is of the best. An individual ventilated metal locker is provided for every employee. Individual enameled wash bowls supplied with hot and cold water are provided in the proportion of one bowl for every three workmen. The drinking water is supplied through bubbler fountains and these are distributed at convenient points over the entire manufacturing area. The toilet utilities are placed in marble stalls, fitted with nickel trimmings and so arranged that each room can be completely flushed with a hose through a space some four inches in height between the floor level and the bottom of the surrounding partitions. These partitions from a height of four feet up are of clear glass.

As mentioned above, the entire plant is sprinkled. A part of the piping and numerous sprinkler heads can be seen in Figs. 1, 10 and 11. These same illustrations show the location and arrangement of the Cooper-Hewitt lighting units.

In the list of services supplied from the power house it has perhaps been noticed that steam is not mentioned. Wherever heat is required for soda-water kettles, glue pots and the like, it is obtained from natural gas. No steam whatever is taken from the power house to the shop.

CRANES AND HOISTS

The manner in which cranes and hoists have been installed is of special interest. Turning to the illustrations, a five-ton traveler serves a part of the assembling department as seen in Fig. 1. In Fig. 4 another five-ton traveler is shown serving the planer department.

At the right, in Fig. 5, are shown two I-beam girders running lengthwise of the shop over a part of the scraping department, supported on structural-steel columns bolted to the floor, and having suspended therefrom, running crosswise of the shop, a number of I-beams carrying trolleys with chain and pneumatic hoists. At the left in this same view can be seen a number of jib cranes of unusual design.

Fig. 6 gives a detailed view of the hoist rails and their supports, while at the right, in Fig. 7, is a detailed view of one of the jib cranes. As shown by the halftones a large number of these latter cranes is in use; each has a lifting capacity of 1800 lb. at the end of the boom. Each is built up of structural steel members fastened to a large cast-iron plate at the bottom, which in turn is bolted to the concrete floor. The swiveling mast is pivoted upon a 2-inch steel ball. This mounting is so free from friction that a pull of the little finger on the hook of a hoist at a distance of 3 ft. from the mast is sufficient to swing the boom with ease.

These cranes although bolted to the floor are not permanently fixed in position but can be moved to new locations if desired. In general they are used to

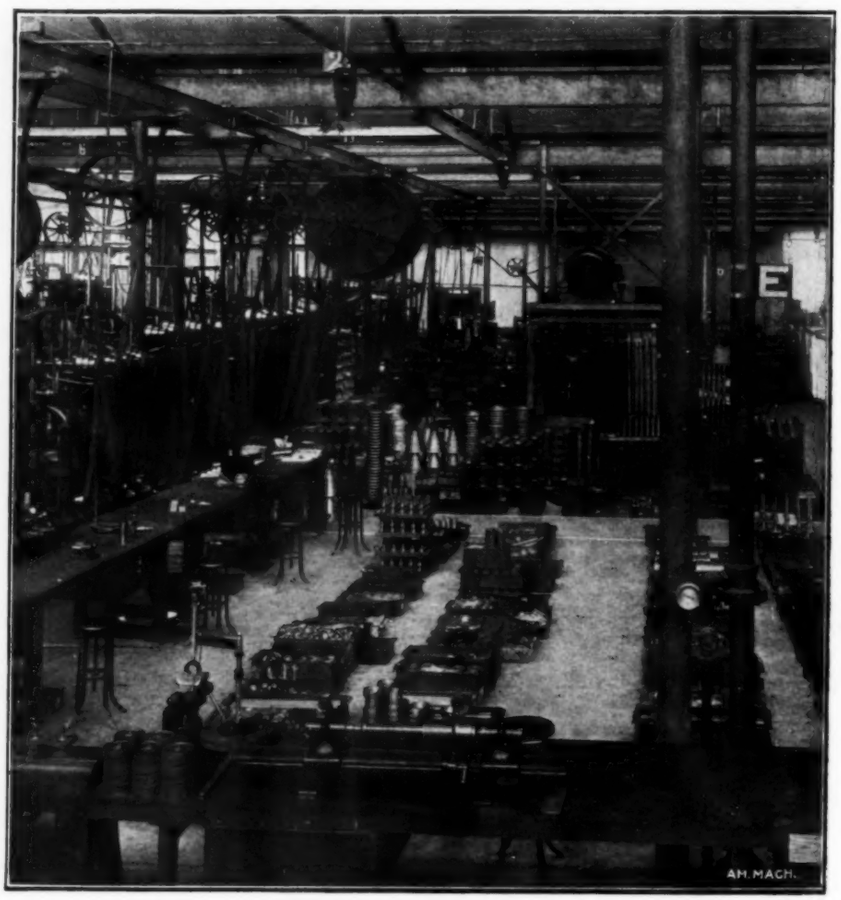


FIG. 9. A MOTOR SUPPORT AND HIGH-SPEED DRIVE FOR THE DRILLING DEPARTMENT

serve individual machine tools with the exception of the large planers which are tended by the overhead traveler. These cranes were designed at the plant and built at moderate cost.

Power Distribution

The machines in the plant are driven both by individual motors and in groups.

Fig. 10. Finished-stock Storage in the New Building

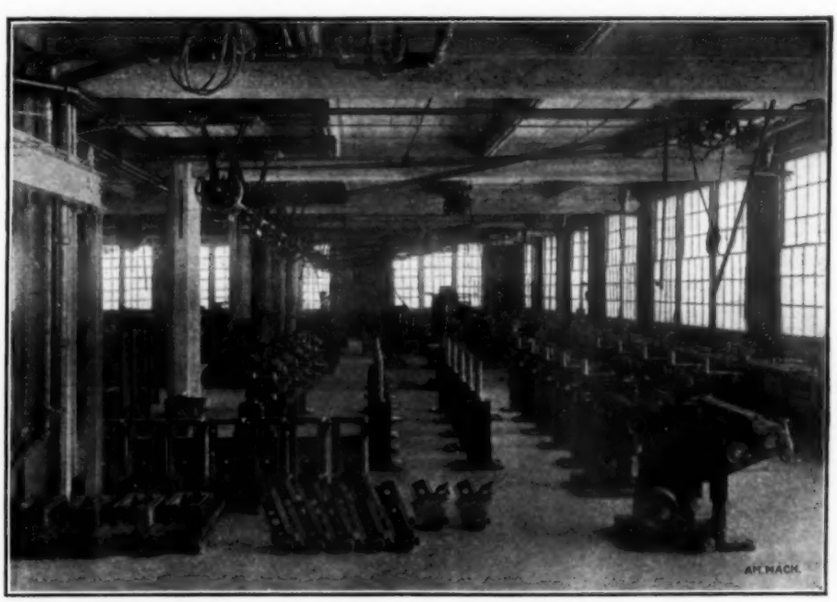


Fig. 11. Method of Supporting Line Shafting in the New Building

Individual motors are used on the large machines under the crane, on all screw machines, chucking lathes, boring mills, large millers, radial drillers, on some of the grinders and in a few other cases. The governing reasons for providing a machine with its own motor may be one or more of the following: (a) To obtain convenience of operation; (b) to obtain variable speed; (c) to obtain the necessary power; (d) to do away with belts and countershafts in the craneway.

No general scheme for the arrangement of the motors has been adopted but each case has been provided for on its own merits. The machines shown in Figs. 4, 7 and 8 are driven by individual motors. In Fig. 9 is shown a small motor resting upon a steel structure some 10 ft. from the floor and driving a large pulley on a line shaft of the drilling department. This particular drive is of interest as showing the use that is being made of narrow, high-speed belts.

This particular driving belt from the motor has a speed of 5700 feet per minute driving a line shaft at 300 r.p.m. The idler shown in contact with this belt is used only for starting purposes; when under load the sag of the belt drops it free from the idler. Although this is the highest speeded driving belt in the plant, many of the others are run as fast as 3000 feet per minute—a speed considerably greater than those commonly used in machine shops. The line-shaft speed for all departments except drilling is 170 revolutions per minute.

Turning again to Fig. 9 in the upper left-hand corner is shown the steel structure used to support the hangers for main-line shafting. This consists of a pair of channel beams placed back to back and spaced apart a sufficient distance so that the feet of the hangers can be clamped to the lower flanges of the beams.

In the three-story building cast-iron T-slots have been cast into the lower faces of the concrete beams permitting the inserting of a T-headed bolt to fasten fixtures into position. This slot system is shown in Fig. 10, and a line of shafting bolted in place is shown in Fig. 11. In both of these illustrations it will be noted that a section of this cast-iron T-slot some 3 ft. in length has been cast into alternate faces of the interior columns near the top. This provides means for fastening fixtures to the columns if desired.

A Few Features of the Machine Equipment

A few of the interesting features of the machine-tool equipment are shown in some of the illustrations. In Fig. 4 of the planer department can be seen a number of long bed planers; the longest have 40-ft. platens. These permit the ganging of a large number of castings for the planing operations. To illustrate, one size of miller column is handled in gangs of 14 castings each. All of the planers have a constant, high-speed return and variable cutting speed.

In passing, the aisle in this view and also in Fig. 5 should be noted. It is 8 ft. wide, is lined off with white paint and must be kept clear. Helpers are instructed to move all material that they find in this space.

In the scraping department a hydraulically operated pulling machine is used to rub the saddles along the tables in locating the high spots by using red lead. This machine can be seen between the first two jib cranes of Fig. 5 and at the extreme right in Fig. 6. The scraping tables are arranged radially around the pulling machine which can be swung and elevated to serve any one of them. This pulling machines relieves the scraper hand of the fatiguing labor of rubbing heavy machine parts together, and thereby becomes a time saver.

The tall machine shown in Figs. 7 and 8 is a special, vertical-column boring machine, designed and built in the

plant. It is used to bore simultaneously the holes for the spindle bearings and overhanging arms. Both boring bars and table are pneumatically controlled.

At the front left-hand corner of the machine is an elevating platform on which the operator stands and by its adjustment brings himself into the most

FIG. 12. THE DIVIDING-HEAD TESTING DEPARTMENT IN THE NEW BUILDING

convenient position to do his work. Two sets of operating handwheels and levers are provided, rendering operation easy wherever the workman may be. In Fig. 8 is shown the rack for the bars used on this machine.

Fig. 12 shows the inspecting fixture for dividing heads. The bench upon which it rests is typical of the work benches installed. Here every dividing head made is brought and subjected to a rigid inspection.

In other departments of the plant is highly specialized machine equipment having many machines especially fitted up for particular jobs which are never done elsewhere.

The Official Patent Gazette

The United States Patent Office "Official Gazette" for Jan. 16 contains a new feature which has been desired for a long time.

Hereafter in the heading of each patent there are to be inserted the numbers of the class and the subclass under which the patent has been classified.

Foreign countries have always shown in their official publications the classes in which the patents would be found, but here it has been necessary to write to the commissioner for such information.

In conjunction with this new plan the office should prepare and publish at least once in each five years a list of subclasses showing the number of patents issued in each subclass. This has not been done since 1902, and that list is not only deficient as regards the number of patents at the present time, but a great many new classes and subclasses have been created during the interval.

Under the conditions suggested anyone could look up a patent, see in what subclass it is classified.

Aluminum vs. Sheet Steel

BY F. C. SKILES

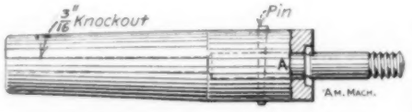
In our work of manufacturing, it was decided to attempt the use of aluminum for an article previously drawn from sheet steel. There were four forming operations and when steel was used it was necessary to anneal the metal after each forming. The operations went well when aluminum was used for the first three draws, but in the fourth draw the metal became so hard that it tore, and, of course, it was then impossible to proceed.

We therefore annealed the pieces by immersing them in oil at 620 deg. F. and then in cold water. After this was done the pieces were given the fourth draw and finishing operations, with no trouble whatsoever.

Interchangeable Arbors for Gear Cutters

BY C. R. TRIMMER

The arbor shown in the line cut is used exclusively in our shop in place of the old solid arbor. It should be



INTERCHANGEABLE ARBOR

carefully made so that the central hole is true with the outside.

The central stem *A* is made of drill rod hardened on the threaded end but left soft on the other end so the two parts can be pinned together. After hardening it is ground to fit the hole in the socket.

The 3/16-in. hole in the socket is used as a knockout in case the stem breaks or must be renewed for any reason. The stems being cylindrical, are easily made and the end for the reception of the work can be ground any size equal to or smaller than the hole in the holder.

Squares of Decimals

BY MATTHEW L. MASTEN

Referring to the table of squares, cubes, etc., on pages 348 to 360 in the "American Machinist's Handbook," I have increased the usefulness of this table to myself in this way:

In order to use the first and second columns for thousandths of an inch the procedure is as follows: For thousandths in the first column, prefix a decimal point to the items containing three numerals, thus:

$111 = 0.111\ (\frac{111}{1000}),\ 399 = 0.399\ (\frac{399}{1000})$, etc.;

and prefix ciphers and a decimal point to bring the items 1 to 99 to three places, thus,

$1 = 0.001\ (\frac{1}{1000}),\ 99 = 0.099\ (\frac{99}{1000})$, etc.

For thousandths in the second column, prefix a decimal point to items containing six numerals; thus, 0.399 squared = 0.159201; and prefix ciphers to all items containing fewer than six numerals (raising the item to six places); then prefix the decimal point; thus, 0.001 squared = 0.000001; 111 squared = 0.012321.

This table treated in the above manner, can be most advantageously used in taking measurements of small pieces or parts of adding machines, typewriters, etc., and in laying off work requiring precision. The rules given can be applied to any item between 1 and 520 (the range of the table in this instance), thence upward to and including 999. The squares must be found by the user, of course, when the item is over 0.520; thus, $0.999^2 = 0.999 \times 0.999 = 0.998001$.

An Intensifying Solution

BY J. M. HENRY

I recently read a number of suggestions on the subject of intensifying solutions, but so far have not seen one which gives any proportions as to the use of the solutions mentioned. I suppose the writers intended to promote investigation and experiment and the following are the results obtained from mine:

Bichromate of potassium in crystal form is as cheap as any compound and answers the purpose very well. It is used in the proportion of ½ lb. of crystals to 1 gal. of water. Let it stand until thoroughly mixed and the solution will be of a deep orange color. In intensifying, use one ounce of this solution to 3 gal. of the water in which the prints are to be washed. Use a measuring glass, this guarantees a uniform result.

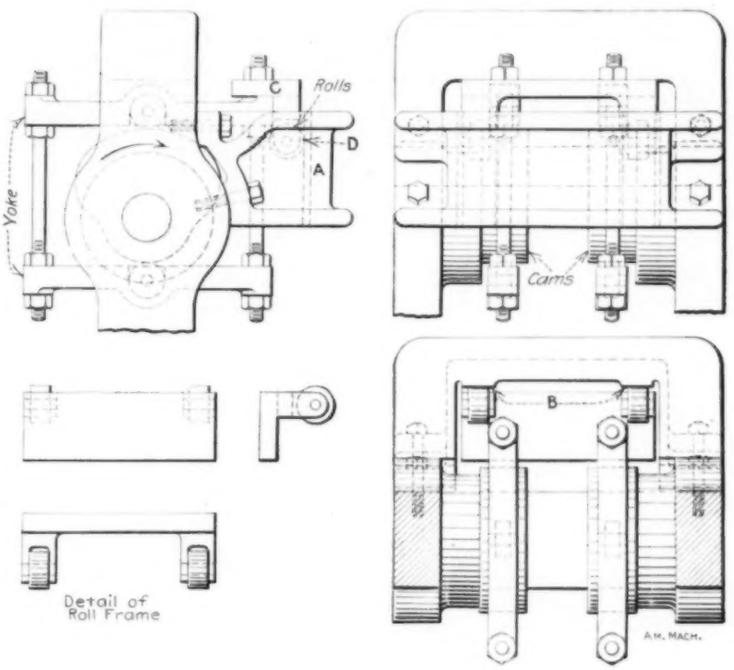
The trouble taken in this way more than pays as it saves "lifeless" prints otherwise worthless.

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Double Action Press Yoke Guide

The accompanying cut shows the manner in which we overcame the cramping action on the yoke of a large double-action press caused by the pressure of the steep rise of the cam against the rollers.



DOUBLE-ACTION PRESS YOKE GUIDE

We made a strong, rigid bracket *A* which was securely fastened to the press frame in the proper position, and had two bearing surfaces *B*. A roll frame *C* was made of steel and bolted to the yoke as shown, and this frame carried two hardened and ground rolls *D* with wide faces, which ran on the surfaces *B* of the bracket *A*, the action of the rolls on the bracket guiding the yoke as it moved and preventing any tendency to bind.

We have had no trouble with the press since this attachment was put in position although previously the management wanted to dispose of it as scrap, the only thing which deterred them being that it was a very heavy, expensive machine, made to suit certain requirements for a special job.

Waterbury, Conn. M. L. MODERN.

A Presiding Genius for the Toolroom

After reading different articles on various systems for eliminating the chances of error in a workman's daily toil, I believe that there is one that a great many people have overlooked. This is in the toolroom. Not the toolroom where the tools are made, but the little cage in the small shop employing from 30 to 50 machinists and tool makers, wherein the tools are stored.

As a general rule a boy from 14 to 18 years old who knows nothing of even the rudiments of the machinist's trade is in full charge. In the first place he seldom exercises any care in handling the tools. If he is a little rushed he generally throws the tools on a bench inside, one on top of the other, and is not very particular how hard he throws them. When the rush is over he puts them in their proper places. But what are the results when a man goes to use these tools again?

The machinist gets a reamer, measures it for size, reams a hole in the work he is doing, not noticing the burr that has been raised on one of the teeth. As a result the hole is ragged and from 0.002 to 0.010 large. The job is either spoiled or the man who assembles it shuts his eyes when he puts it on. When the job comes back as it frequently does, who is to blame? Nobody! At least no one will admit the fault.

Another instance is where an expensive thread plug gage is battered up on the front end. Expensive plug and ring gages are put away without a drop of oil and are allowed to rust. I recall one instance where I saw a boy with all the plug and ring gages out on the bench. He was trying to drive one of the plug gages into the ring gage with a hammer. I asked him what in the name of sense he was trying to do. His answer was that he just had some new tools come in and having no drawer to put them in, thought he would double up by putting the plug gages inside the ring gages and then put them all in one drawer.

It operates thus all the way through. A man asks for a $^{33}/_{64}$-in. drill and a ¼-in. reamer and is given a ¼-in. drill and a ¼-in. reamer. If he does not take time to measure the drill, he will have some poor ¼-in. reamed holes.

But the boy is not to blame. He does not know any better. There is a cheap and effective remedy for this. Every now and then, no matter where you are working, the boss will hire a cheap man who is what one would call a halfbreed machinist. He will likely go along for a little while and some fine day will spoil a lot of work and be discharged.

This man at least knows what the tools are used for; he is a cheap man and is just the kind to put in the toolroom. He very likely will be able to tell a ¼-in. drill from a ¾-in. drill without measuring it and will know enough not to pile the reamers on top of one another. The difference in his and the boy's wages will more than be made up in the saving of tools and elimination of mistakes.

Chicago, Ill. FRANK E. ARTZ.

Draftsman's Checking Card

My checking card has worked successfully and is applicable in either a large room where many drawings are made or in a small room where a single draftsman is dependent upon his own checking.

The card is 3x5 in., and contains the items of importance which must be checked. It can be tacked to the board

or clipped to a pad of paper. Then as the checker finishes checking one item on the drawing, he can check the item on the card, or on the pad beside the item.

Any chief draftsman could make up a checking card to include such items as are important in his shop.

CHECKING CARD
Drawing No.
Title
Scale
Initials
Detail No.
Quantity
Material
Pattern No.
Finish Marks
Dimensions
Arrow Heads
Thread Specified
Fit Specified
Allowance
Limits
Notes

AM. MACH.

DRAFTSMEN'S CHECKING CARD

In a large drafting room, the chief could insist upon the checkers using the card. This would act as a check on the checker, and he could never have any excuse to offer if he should let something slip by that was itemized on the checking card.

New Haven, Conn. R. L. MUNN.

Filing Advertising Pages

Probably everyone who reads his AMERICAN MACHINIST carefully, also reads the advertisements. Systematic use of the selling section has been of such great help to me, that I gladly recommend it. The scheme is merely this:

I have a loose-leaf notebook in which two or three of the best advertisements from each issue are pasted under one or the other of the following heads. (1) Rapid work or unusual jobs. (2) Methods of testing machine tools or fixtures. (3) Tools desirable to purchase. (4) Tools and fixtures, to be used as suggestive in the design of homemade articles.

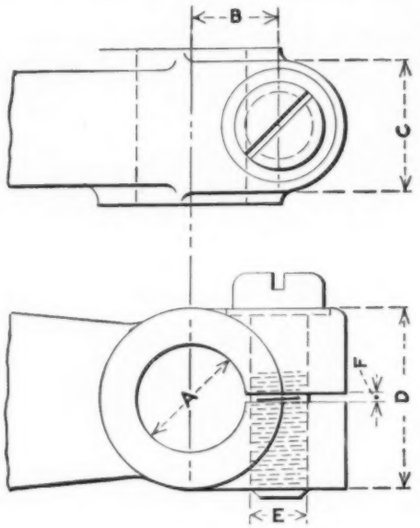
Under No. 1 for example, can be found: (*a*) Seven high-speed milling cutters milling a table; chips removed 40 cu.in. per minute. (*b*) 160 lb. of chips removed in one hour on a 12-in. geared-head engine lathe. (*c*) Microphotograph of chips from a modern grinding wheel.

One can count on these advertisements as giving fairly accurate results of the best and latest work of the manufacturer. This Ad-scrapbook may contain a brief up-to-the-minute record of things the apprentice wishes to learn, the designer wishes to study and if possible improve upon, and the ambitious foreman wants to surpass with schemes of his own.

Boston, Mass. L. J. RODGERS.

Standardization of Rod Ends

In recently designing some small automatic machinery it was found best to have the numerous levers fasten to their shafts by means as shown. All the various sizes of shafts were taken and



A	B	C	D	E	F
1/4"	1/4"	3/8"	9/16"	3/16"	1/16"
5/16"	11/32"	1/2"	11/16"	1/4"	1/16"
3/8"	11/32"	9/16"	3/4"	1/4"	1/16"
7/16"	13/32"	9/16"	15/16"	1/4"	1/16"
1/2"	7/16"	5/8"	7/8"	5/16"	1/16"

AM. MACH.

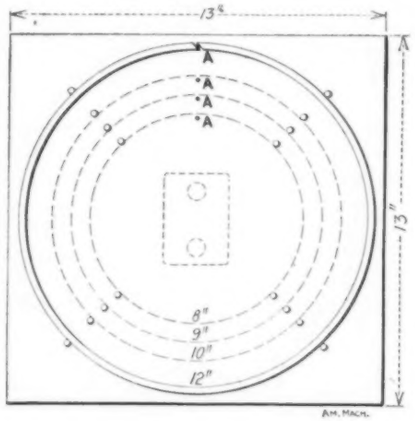
STANDARD ROD ENDS

around them the above proportions were constructed and used throughout the design.

Corona, N. Y. GEO. E. HALL.

Filing Jig for Piston Rings

The accompanying diagram shows a jig for filing small cast-iron piston rings. Anyone who has had occasion to file a



AM. MACH.

FILING JIG FOR PISTON RINGS

number of small rings, a few thousandths of an inch too wide for the grooves, knows of the difficulty in holding them firmly in a vise without danger of breaking.

Take a piece of hardwood board 1¼ in. thick and 13 in. square. Lay off 8-, 9-, 10-, 12-in. circles, or others of a diameter to correspond with the sizes of the rings to be filed. Drill four 17/64-in. holes tangent to the outside of each of these circles ¾ in. deep. Take four ¼x1⅛-in. steel pins; these pins may be put in any set of holes and the ring sprung inside the pins. A small pin at *A* keeps the ring from turning, while a block 2x3x4 in. long, screwed to the underside, gives a good grip for the vise.

MAURICE C. CLARK.

Claremont, N. H.

Conservative Plant Enlargement

A certain manufacturing town in eastern Massachusetts is the largest producing center of its kind in the country, and has always been such. The equipment of some of the plants, however, has not kept pace with the times.

The young technical man, with his knowledge of scientific and efficient means and methods, but without industrial experience, would, with perhaps an ill-concealed feeling of contempt, condemn some of this equipment as junk. But when the practical man is called in, he is able to grasp the fact that sometimes an old concern prefers expending a small, though frequent amount for upkeep, rather than a larger, lump sum, which improved and more efficient equipment would naturally necessitate.

These concerns may, or may not know what they need, but they most certainly know what they want, and they ask the practical man, "How soon can you get it going?" His intelligent grasp of the situation, and his cheerful attack on a decrepit machine, or a wheezy, pounding engine, quickly win for him the respect and the business of the concern.

In such cases, when it finally becomes absolutely necessary to purchase new equipment, it is usually of greater capacity, and is expected to outwear its owners, if repairs and replacements are kept up.

Lynn, Mass. A. B. NAUMKEAG.

The only gas produced from crude oil up to within a very recent period, has been one having a value from 550 to 680 B.t.u. per cu.ft., used for domestic lighting and cooking. This gas has been produced by the process known as the "cracking" of the crude oils, which is largely disruptive in effect and frees a very large percentage of hydrogen and carbon, resulting in a gas carrying 50 per cent. and upward of free hydrogen. This gas will give no higher efficiency in a gas engine than distillate.

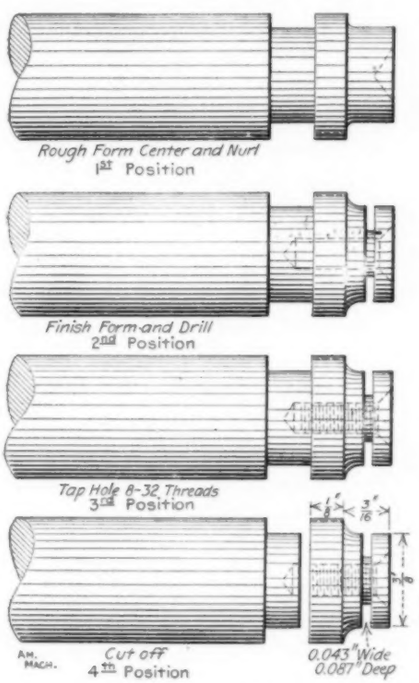
Discussion of Previous Question

Referring to letters and articles previously published

Increasing Screw Machine Output

Having seen several articles of late in the AMERIAN MACHINIST regarding an increase in production of certain pieces on screw machines, it may be of interest to some of the readers to tell what I have done along this line.

As we make thousands of brass thumb-nuts during the year and have only one machine small enough for these, as well as several other pieces



INCREASING SCREW-MACHINE OUTPUT

that must be made on it, it is naturally up to the foreman to do some speeding up of machines once in a while to keep up with the orders.

The brass thumb-nuts mentioned are made from ½-in. round brass rod and are made on a ¾-in. four-spindle Gridley automatic. When the job was first set up, we thought our output of 5 to 6 nuts per minute good; later we cut some of the cams and increased this to 8 per minute, then a few months later we cut the cams some more and increased the spindle speed, which gave us a production of 12 nuts per minute finished complete, and this we thought was the limit of the machine. However, while watching the machine some time ago I decided there was still more to be had out of it so I had a complete set of special cams made and also put the highest-speed spindle gears on, giving a speed of 925 revolutions per minute. The gear feed handle was thrown back in the feed box, the friction clutch thrown in at the back of the machine, allowing the fast motion of the cam drumshaft all the time. The cams used were laid off and cut with just enough rise to give each tool the required depth of cut their entire length.

The piece, four steps in the forming of which are shown in the cut, is rather difficult to form on account of the depth and width of the neck, which is 0.043 in. wide and 0.087 in. deep. We are getting a better finish all over than ever before and the production now obtained by the new method of camming is 16 nuts per minute, a gross production of 960 per hour, or a net production (10 per cent. less) of 864 per hour. High-speed forming and cutoff tools and carbon drills and taps are used.

Detroit, Mich. E. A. PRESTON.

Making Corrugated Cans

The following methods of making this class of work, will I think, be a great improvement over the methods given by Aron Lawrence in his article in Vol. 35, page 752, as it will greatly increase the production.

For the smaller sizes of can bodies, I suggest a combination die for cutting out the blanks and stamping the corrugations at one operation, and then rolling them into shape by means of rubber-covered rollers mounted in housings similar to the set shown by Mr. Lawrence; but instead of having an automatic stop for the rolls on completion of the curvature of each can body, I suggest a sheet-steel plate about 20 gage, hinged on one end to a rod which stretches across the top of the housings, and allowing the other or front end of the plate to rest on the top roller. The body is thus curved by the idler, its leading edge coming into contact with the hinged plate and resting there until the remaining portion of the body is passing through the rolls, after which it springs clear from the rolls and falls into the receiving box. A continuous feed is thus kept up at a high rate of speed.

Another method for producing these bodies would be to use a pair of steel rollers cut to the required section or design mounted in housings with idler and hinged steel plate as already mentioned, but having two or more spring-actuated stops or guides let in to the bottom roll, so that at each revolution of the rolls, one of the plain blanks is fed up to these stops. As the blanks come into contact with the top roll, they are pressed into the bottom roll, the springs forcing them out again immediately after passing clear of the top roll; a constant feed being thereby maintained.

Referring to the question of punches and dies; if the correspondent will adopt the following method of construction he will get 200 to 500 per cent. more work from the dies than he gets at present.

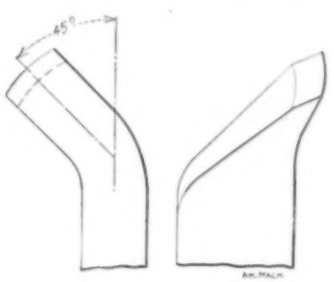
When making the bottom die be sure that the shear is at least twice the thickness of the stock to be cut. Set the punch a dead fit to the die but *do not* leave it *parallel* or *larger* at the back, but make it *smaller* at the back than at its cutting edge, gradually tapering from the cutting edge. This prevents unnecessary chafing of the cutting edge of the bottom die.

If the blanks referred to are to be used for making the seamed ends of the corrugated can shown in the illustration, why not make the ends in a combination die, i.e., cutting out the blank and forming it up to the required shape in one operation, ready for the seaming process? A. WHITBY.

Swansea, South Wales.

Mushet Steel Lathe Tools

The article on lathe tools by R. O. Herford on page 989, Volume 35, brings to mind our first experience with



MUSHET STEEL ROUGHING TOOLS

mushet steel when first introduced many years ago. I believe it is considered good practice in working this metal, to cut to the shape desired. The cut shows some of the first tools I had made and which gave entire satisfaction. They were

roughing tools, and while I later had several other tools made of mushet steel the shape of the roughing tools was never changed.

Birmingham, Ala. W. B. ODELL.

Hardening in Gas and Oil Furnaces

I was much interested in Mr. Dickson's letter, Vol. 35, page 1227, particularly the paragraph in which he discusses the gas flame, etc. I wish he could tell the rest of us just how he knows when he has the proportions given, if he has a special mixing valve, or depends on the color of the flame, and whether he finds it necessary to alter this proportion after the furnace heats up.

Another thing I would like to ask him or any other of the hardening experts is whether they ever found common machine-steel bar stock, about 20 carbon, that would not harden after being carbonized in granulated raw bone at 1650 deg. F. for eight hours, allowed to cool, reheated to 1450 deg. F. and quenched in water, and if so whether they ever found the cause of the failure and what was done to correct it. D. K. BEANS.

Somerville, Mass.

Methods of Writing on Blue-Prints

In Vol. 35, page 848, there are described some methods of making alterations on blueprints, which, no doubt, are all very good in their own particular way, but the quickest, cheapest and easiest method of writing on blueprints I have used consists in bleaching them with a solution of oxalate of potassium and water. Add sufficient acid to bleach immediately after application.

The addition of logwood, which mixes admirably, is very useful to call special attention to any particular part of the blueprint.

London, Eng. R. W. WILSON.

An Improvement in Screw Heads

Both your screwdriver correspondents in Vol. 35, pages 991 and 992, omit to mention one small detail. The two edges of the so called point should be very slightly rounded. If such a driver slips out, it will damage the head of the screw less; particularly if otherwise shaped as shown in Fig. 3, page 991, of the same volume, it is much less likely to break the head of the screw.

OSCAR ECKENSTEIN.

London, Eng.

Interchangeable Floor Boards

The entire finishing surface of a shop floor, if of wood, should be in short pieces, say four feet long, and of exactly the same width, so that when a section has to be renewed it is only necessary to remove the worn-out pieces with a crowbar and drop in new pieces of the same size, and the new breaks will joint as at first. It works in practice.

Syracuse, N. Y. JOHN E. SWEET.

Jig and Fixture Defined

Fixture—A device to be fixed to the movable part of a machine tool—the faceplate of a lathe or the table of a miller, planer, shaper, etc., to hold work for certain operations. The fixture is generally in motion while the work is being performed.

Jig—A contrivance for holding work while it undergoes various machine or hand operations, as drilling, boring, reaming, tapping, bending, filing, sawing, assembling, etc. It is generally used on a stationary table as a driller or borer, at the bench or in the vise. Drill jigs for making or finishing holes are most common.

Fixtures as above defined are sometimes spoken of as jigs but jigs are not often called fixtures. The words are carelessly used by many men and their use varies in different drafting rooms.

Durham, N. H. JOHN C. TONKIN.

Although the terms "jig" and "fixture" are often used interchangeably, there is little difficulty it seems to me in determining what is a jig and what is a fixture. The ordinary meaning of the "fixture" (a thing firmly fastened in place) suggests what work-holding contrivances should be called fixtures. I should define the terms as follows:

Jig—A contrivance fastened to, or inclosing a piece of work, and having in correct relation thereto surfaces to guide a tool which operates upon the work.

Fixture—A contrivance which is fixed to a machine and has arrangements for correctly locating and holding work which is to be operated on by a tool.

It is incorrect to limit the term "jig" to only those tools which have hardened bushings. Jigs are frequently made of machine steel and not hardened. They are sometimes made of brass and I suppose many carpenters have made use of wooden jigs, though not calling them by that name. The following functions of jigs might be mentioned: Center dotting, drilling, reaming, boring, drifting, broaching and tapping. Jigs are not usually fastened to machines, and when they are fastened it is generally for the sake of safety.

Fixtures, on the other hand, are always fastened. There is only one function for a fixture, i.e., to hold the work in correct position. Among its applications may be mentioned milling, planing, shaping, slotting, straightening, grinding, centering and a great variety of lathe work. It should be noted that the tool is always free, being capable of more or less adjustment in relation to the work in contradistinction to the rigid guiding surfaces of a jig. Thus, a lathe faceplate fixture loses its character as a fixture as soon as a bracket carrying a bushing for guiding a drill is added, and becomes a jig.

Brooklyn, N. Y. F. J. BADGE.

At page 155, Vol. 36, you solicit definitions of the difference between the terms "jig" and "fixture." I would give the following:

Jig—A jig is a tool or contrivance under which a piece of work may be laid or inclosed therein, having hard-steel surfaces with arbitrary measurements by which the work must be done, either by drilling, filing, planing, or otherwise and which eliminates the use of a ruler or calipers to lay out the work.

Fixture—A fixture is simply a tool or contrivance for holding work in position for doing different operations, such as drilling, filing, planing, milling and laying out. It has no fixed dimensions like the jig, and requires the laying out of work by rule or otherwise. It obviates the necessity of looking up supports, etc., whenever the same line of work presents itself.

Schenectady, N. Y. DAVID MILLER.

I see that one of your readers wishes to know how to distinguish between jig and fixture. I have followed the trade for twenty years, and always understood the word "fixture" to apply to a contrivance that was *fixed* or fastened to a miller or planer and intended to hold a piece of work in a certain position for machining.

The word "jig" is applied to a contrivance usually used for drilling a piece of work through bushings, or sometimes for holding work to be filed to conform to the shape of the jig. The jig is usually a movable, instead of fixed contrivance.

Syracuse, N. Y. MARTIN VAIL.

In answer to your question "What is the Difference between Jig and Fixture?" I can only give you the distinction as used by myself for the last 34 years in my own shop.

A jig is a form to be fastened to the piece that is to be operated on, by screws, bolts, clamps or in any other way. These two or more pieces when so fastened are entirely independent of any machine, and can be carried or moved about without moving any machine.

A fixture is a form fastened to a machine, by screws, bolts, clamps or in any

other way. The fixture has become fixed, and is part and parcel of the machine and cannot be moved without moving the machine while so attached. The duty of the fixture is to hold the piece to be operated on. R. K. PEARCE.

Island Heights, N. J.

Since there seems to be no definite rule to distinguish the words jig and fixture, why not establish a definition? Nearly everybody agrees that up to the present date either word may be applied in description of either tools; that is, a jig may be called a fixture or a fixture may rightly be called a jig.

This question brings up others, as: At what size is a pin distinguished from a rod or shaft, and what dimensions are to distinguish a bolt from a screw? Should a stud be classed as a headless screw or (if it is long and slender) as merely a threaded wire? A hammer large enough may be called a sledge, etc.

A workman once jokingly remarked: "Fixtures were the kind that were fixed and jigs were the kind that were moved about in operation, and perhaps this is the best logic after all, because there seems to be no other way of classification. The latest edition of Webster's Dictionary says that a fixture is an attachment; it should therefore follow that holding devices which are not attached, should be called jigs.

In order to further distinguish, we should not call a jig a fixture when it is clamped down with clamps, but when a holding device is built to provide for clamping or fastening to a machine, bench, etc., it becomes an attachment, and therefore a fixture. For instance, one operator holds a drill jig in his hands and another fastens the same jig to the table with a clamp. This does not change the name; the device is a jig and the manner of holding should not make it a fixture.

The prevalent idea is that a jig is a holding device used on the driller. This is probably due to the fact that most movable holding devices are used on the driller. Others are under the impression that a fixture is used on the miller; but, of course, both are used on different machines, and also on the work bench.

Some will be in favor of dropping the word jig and of using fixture for everything, but the correct use of both words would be an advantage when taking inventory. As both are used on a variety of machines, classification according to the machine on which they are used would be confusing. The distinction is made only when proper definitions are established and understood.

Harrisburg, Penn. S. N. BACON.

I notice at page 155, a question as to the definition of jigs and fixtures.

I think you will find that the common line of distinction in the mind of the designer as to these terms is to the effect that a jig is a small device which holds the piece to be operated on, and at the same time guides the cutting tool, while a fixture is a device which simply holds the work.

This has been the common understanding in several firms with which I have been associated, and is followed by a number of designers with whom the designation of such equipment rests at the present time.

J. A. PRATT.

Williamson School P. O., Penn.

Concerning the question in the AMERICAN MACHINIST in Vol. 36, page 155, as to the difference between "jig" and "fixture" as applied to shop practice, I would like to state as a tool maker that there is in my opinion a distinct difference.

A jig is a tool or contrivance used for holding or machining work that is to be duplicated and has for that purpose hardened surfaces that guide the tools that do the machining or cutting.

It may or may not be fastened to the machine on which it is used but the idea is to put the tool in the same place always; therefore it is necessary to have the hardened surfaces with which to guide the cutting tools. The accuracy of work done in a jig depends upon these hardened surfaces which guide the tools.

A fixture is a tool or contrivance for holding work while it is being machined and is fastened, or made temporarily a part of the machine on which it is used. A fixture does not have hardened surfaces to guide the tools but simply holds the work while it is being machined.

For instance, a fixture is put on and made a part of the planer, miller, tapping machine, or punch press and simply holds the work while the tool cutter, tap or punch performs its functions.

The accuracy of work held in a fixture depends to some great extent upon the machine on which the fixture is fastened. Adjustments are made with the machine by the operator. A. W. FELKER.

Wilkinsburg, Penn.

The Technical Undergraduate

Without any thought of criticizing Mr. McConnell's view of the technical undergraduate in Vol. 36, page 94, I would like to present a different view of the same lot of boys, or of a comparatively recent lot of them.

This view is based on the fact that most of these boys, whether they graduate or are weeded out, fall on their feet soon after they come in contact with the bread-and-butter proposition. It is an undoubted fact that boys make their selection of a lifework, or their parents make it for them, with very little regard for the necessary scientific basis. This will probably remain the case for some years to come. In the meantime boys will continue to go to technical schools without an intimate knowledge of the things that they go there to learn.

Today it is almost impossible for a boy, here in the East at least, to come into close contact with any trade except by entering the shop as a workman. When I was a small boy the doors of my father's shop stood wide open six months in the year and every operation was carried on in full view of the street. Any boy who had a hankering for blacksmithing could find out whether it was anything more than a hankering by hanging around. When we couldn't chase them away we roped them in and set them to work. Even they did not know the names of all the tools we used.

From my point of view the technical freshman is, on the average, a healthy young animal with a liking for books and also with the kind of a mind that is restless unless it can set the hands to doing something. He may not have any definite idea of a trade or profession but he wants to make the wheels go around. That much is born in many men, regardless of any lack of technical knowledge. If that is there it matters little if he has no definite idea along any one line of work. In fact he is just that much more receptive and has just that much less to unlearn.

All in all these boys come to school in a state of mind that is commendable whether their previous curiosity has been satisfied or not. They are quick to pick up new ideas and they very often far outstrip their better informed mates. The class of young men of whom Mr. McConnell speaks come from secluded regions of the city or country without the opportunities for knowledge that his technical-high-school educated friends have.

They enter with conditions and they have a disconsolate time the first year; but watch them through, and you see those chaps close up to the top of the class by graduation and away in the lead later in life. Why? Simply because they had, that best of all good fortunes, the habit of work, which our city boys do not get at all unless they come from the seemingly hopeless ranks.

As for the bright boy who reads the AMERICAN MACHINIST regularly and talks with his engineering friends about something besides the baseball score, he is going to succeed anyway, so why bother with him at all. Of course, it is nice to get him into the technical schools because his name looks good later on when the annual catalog is published, but I believe that technical schools do and should belong to the fellow who needs help to "get there."

Worcester, Mass. E. H. FISH.

Standardization of Machine Tools

The discussion of this subject up to and including the article by Mr. Schellenbach, in Vol. 36, page 89, indicates that there may be some misunderstanding of Mr. Alford's intentions in writing the original paper.

Mr. Schellenbach himself appeared a little uncertain in this direction when, on page 90, he indicated his dissatisfaction with electric motors for application to machine tools. His apparent inconsistency is offset by the doubt as to whether standardization could be brought about. Inasmuch as machine tools are made to sell, and as the manufacturers thereof are in the business more for profit than for the purpose of employing engineers, it seems likely that they will ultimately find that the line of least resistance lies in the direction of standardization.

If it ever becomes evident that machine-tool builders want standards observed for motor feet and center heights, the electrical people will offer motors made to such standards, and if machine-tool builders find that their customers want certain parts standard, they will furnish them. The U. S. standard screw thread has been offered for years, and yet there are some screw threads cut that are not standard; cap screws and bolts that are not standard can be bought anywhere. Does anybody advocate throwing out the U. S. standard thread because it is not universally used? And would anyone advocate anything in the way of universal and compulsory standardization of machine tools? I think not.

A society like the American Society of Mechanical Engineers, or the National Machine Tool Builders' Association, or an individual like Jarno can set up a standard, and anyone who wishes may follow it. A good standard properly presented to the public will gain strength as time goes on, and a poor standard will lose ground. A good standard is better presented to the mechanical public through the medium of some society in which that public has confidence than through an individual, simply because of the prestige thus given its introduction.

No one has ever thought that the adoption of a U. S. standard thread has been any argument for making lead screws, or crossfeed screws to that standard. There is an Acme standard thread for that purpose, and its adoption almost universally for that purpose is certain in the course of time, unless a better standard is found.

On the other hand, if the National Machine Tool Builders' Association should adopt a standard diameter and pitch for lead screws for 24-in. lathes, it, at the start, would simply indicate to the purchasing public than a lathe having such dimensions was so proportioned in that respect as to meet the approval of a body of men, whose opinion was valuable.

If that association should adopt a list of standard dimensions for engine lathes, it would not be a week before our really enterprising machine-tool men would be advertising that their machines were in every way "up to the standard," and every man who knew what the standard was could make his comparisons himself. The nontechnical buyers could furthermore rest assured that they were not buying an inferior machine, so far as a design went.

It seems to me that there is no reason for waiting to be "dead sure" that we have the best thing before standardizing it, nor do I see how it would handicap designers to find that the diameter and lead of a lead screw had been standardized. Take the case of the 24-in. lathe mentioned above: I have used lead screws from $1\frac{7}{16}$ to $1\frac{13}{16}$ in. in diameter, and leads of 6, 5, 4 and 2 pitch at various times.

Suppose the National Association had declared for $1\frac{1}{8}$-in. diameter and 4 pitch. I would then have had a basis to work on, and would have hesitated long before building a lathe with a finer thread or smaller diameter. Moreover, I would not have used the coarser thread or the larger screw unless I fully thought that there was an advantage in so doing that would appeal to the purchaser with sufficient strength to make him pay more for it. The chances are that the purchaser would prefer to have the lead screw standard, and the more standard lathes he had in his shop, the more anxious he would be to have the rest standard.

Many shops have standards of their own with which purchasers must comply. I have in mind a prominent shop in western Pennsylvania which manufactures gages for the noses of spindles for all lathes or tools which require chucks. If any considerable variation occurs from the manufacturer's standard, this shop is willing to meet him more than half way in the matter of expense. They have many special fixtures which are shifted from lathe to lathe, as changes occur in the volume of business on any one size of their product, and it pays them well to be able to make these shifts.

What objections there can be, from the user's point of view, to the standardization of tool holders I do not see, provided the holders are made large enough to take care of all legitimate needs. If you have a hole in the barn door large enough for the cat, it is not necessary to provide smaller ones for the kittens. A standard hole made to fit the largest cat in town is all that is necessary. In the same way, if it should be decided that a 24-in. lathe required a tool post that would take $\frac{3}{4}$x$1\frac{1}{2}$-in. steel, it would imply that the standardizing body regarded that size as large enough for any legitimate duty of that size lathe.

If someone wished to get into the limelight by offering a lathe having a tool-post opening for 1x2-in. steel, he would be taking a chance that it would be an inducement to the buyer, or a "talking point." If he found that the purchasing public was more interested in the quality of the workmanship in the lathe than in that detail, he would soon revert to the standard.

Mr. Schellenbach is undoubtedly wrong in his effort to discredit the geometrical ratio for machine-tool speeds. If it were known that a certain lathe were to be used only on certain sizes of certain materials of certain degrees of hardness, then it would very likely be desirable to design it to give certain definite speeds that would appear to best fit those sizes, etc.

As a matter of fact, the builder of an engine lathe has no possible suspicion as to what work may be put into it after it leaves his shop, except in rare cases. He must design for the general public. Under such circumstances the law of chances indicates that the least waste of time will occur when the variation of speeds is in geometrical ratio, rather than any hit or miss rates.

Worcester, Mass. ENTROPY.

A Covering for Cement Floors

Although there may be no danger of permanent physical disorders due to working on cement floors, some feel more fatigued at the end of a day's work than where a softer floor covering is employed. Still where the floors are already laid in cement it is not always possible to change immediately to a more desirable surface, even though the men show signs of weariness and tools as well as finished work suffer from being dropped.

A good way to offset the undesirable features of cement floors is to lay in front of the benches and lathes as well as the other machines, sheets of 3-ply roofing felt which can, in warm weather, be cemented to the floor with the same kind of cement used in making the joints on the roof. This covering lies flat, is easily swept over, is pleasant to work on and wears surprisingly well considering the character of the material. In front of a bench where men spend a great part of their time at the vise the covering will give good service for ten to twelve months. The price too, is greatly in its favor, as the cost is less than three dollars per hundred square feet.

Galesburg, Ill. H. C. SUNDELL.

Always keep the crucibles used in casting brass in a dry place, for if this rule is followed, as high as thirty heats can easily be obtained from one crucible.

Machining Methods at the Watertown Arsenal

EDITORIAL CORRESPONDENCE

An interesting job in the shape of an improvised horizontal boring machine for finishing the hydraulic cylinder of a disappearing carriage at the Watertown

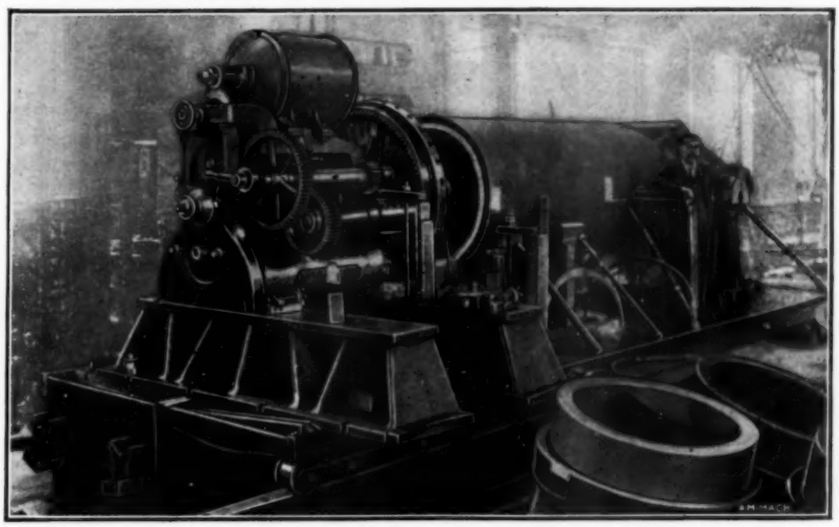


FIG. 1. A LARGE IMPROVISED HORIZONTAL BORER

Arsenal is shown in Fig. 1. Having no boring machine which would accommodate this particular piece, a machine was improvised by using the head of a large lathe temporarily on the extended table of a large planer, which was not in use and which provided an excellent bed for the machine.

A method of planing grooves of varying depth in the bore of a hydraulic cylinder is shown in Figs. 2 and 3. The cutting tool *A*, is mounted in the end of a massive pivoted bar *B*, and is governed by the follower *C*, on the other end of the bar, traveling on a hardened surface which acts as a former. This is of such shape as to move the tool vertically and give the proper conformation to the groove being planed in the cylinder.

The work is turned from one groove to the next by means of the worm gearing shown at the end of the cylinder and located by the index pin. The way the bar is pivoted and the end adjustments of the former with relation to the work are also shown very clearly in Fig. 3.

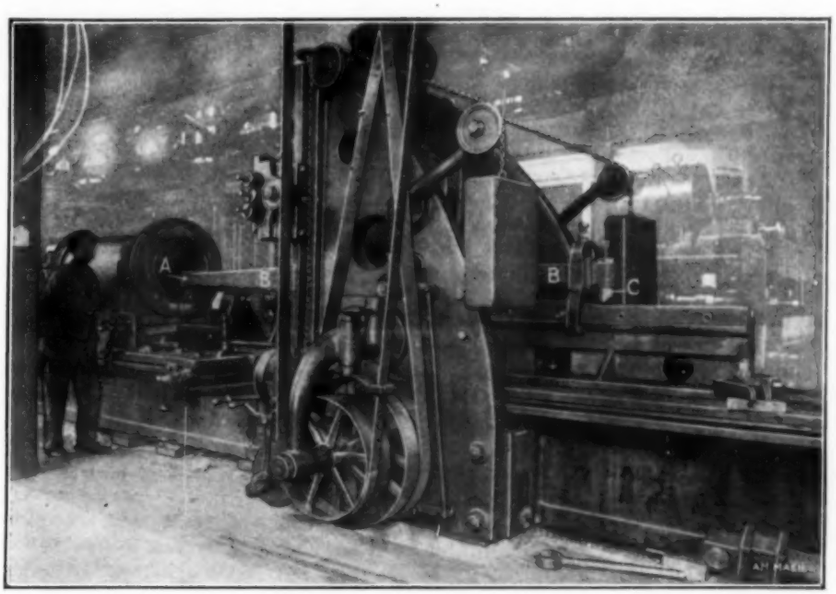


FIG. 2. DEVICE FOR PLANING GROOVES OF VARYING DEPTH

The Development of the Co-operative Spirit between Manufacturers and Users

H. D. JAMES*

The general tendency today among the leading manufacturers, in all branches of industry, is to furnish their customers with satisfactory results, not merely merchandise. This change is taking place through a scientific study of the requirements of each customer, in order to enable him to increase his efficiency or the efficiency of the men under him.

In the field of electrical engineering these investigations are being made, perhaps to a greater extent than anywhere else, in the proper application of motors to various industries. The first steps in this direction consisted in replacing the steam engine by a constant-speed electric motor belted to the line shaft. There are many good applications of this kind today, but a further study of the actual requirements showed that better and more economical results could often be obtained by using an individual motor for each machine. Not only did this eliminate the line-shafting losses, but it gave a more positive drive and turned out more and better work. This latter application required an engineer who understood both the motor and its control as well as the power and speed requirements of the machinery to be driven.

The power plant and transmission line each entered into the problem. The characteristics of the motor and the torque required to start the load determine the maximum demand upon the generator. Where a large number of small motors are used this matter is unimportant, but one or two large motors may seriously interfere with the proper operation of the generator. A motor geared to its load is subjected to vibration, and must stand severe stresses which are not applied to a belted motor, for the belt acts as a cushion.

These one or two references show how the engineering problems of motor application have broadened. The first step toward solving such problems is to develop engineers with the right training and experience. These men must first have a thorough grounding on broad lines so that they will understand the motors, controllers, generators, transformers and switchboards which enter as units into the problem. They must then make a special study of the requirements of the user and the results he wishes to obtain. Tests must be made and data compiled; sometimes experimental applications are made and tried out before a definite decision is reached.

The broadening of the field has reduced the relative area which each man can cover. Engineers are now specializing on groups of applications which are closely related. We have railway, power and industrial engineers and these divisions are again subdivided and the

*Engineer, Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

subdivisions are increasing. Designing engineers likewise have been divided into groups and sub-groups.

Commercially the field is divided into three elements—the user, the manufacturer and the consulting engineer. At first consulting engineers operated as individuals, but now many consulting engineering firms embrace a staff of engineer specialists, its size depending upon the variety of work undertaken. The services of the consulting engineer involved expense which in many cases was not warranted by the size of the work. For this reason the small user came direct to the manufacturing company for advice as well as apparatus, and the large users employed their own engineers, calling upon the consulting engineer only when in trouble or when large installations were undertaken.

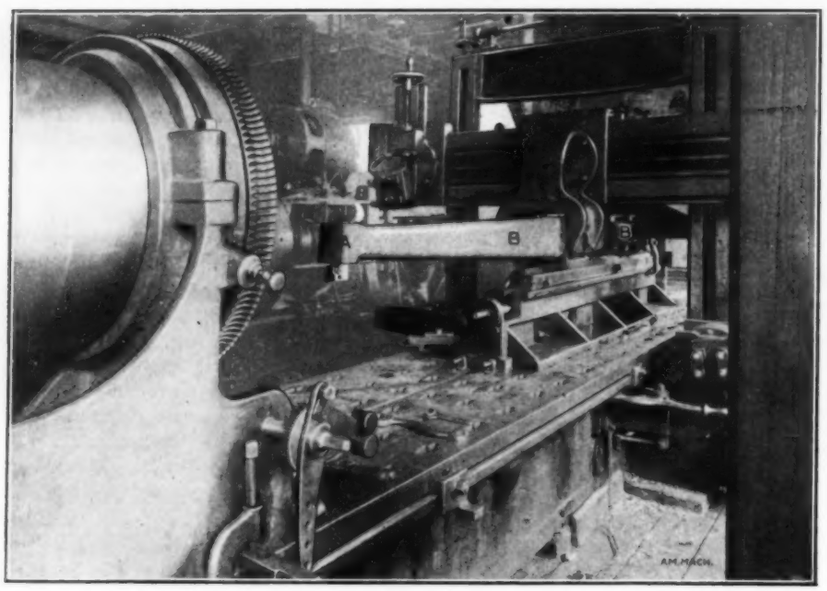


FIG. 3. ANOTHER VIEW OF THE PLANING DEVICE

The consultations with the manufacturers by customers and customers' engineers made it necessary for the former to have some sort of a consulting force to assist in the sale of their product. They did not, however, wish to assume the duties and responsibilities of the consulting engineer for which there seemed to be no direct compensation. The customer, on the other hand, often felt that he could get a less biased opinion from an independent engineer, yet his work may not have warranted such expenditure. The consulting engineer did not always look with favor upon the manufacturers' application engineer, especially when the apparatus recommended was not strictly in accordance with the consulting engineer's specification. The lack of better coöperation between the consulting engineer and the manufacturer's specialist resulted in much special apparatus which would have been avoided by mutual concessions and as good results would have been obtained with a smaller investment.

The manufacturer and user have both found that a closer coöperation in the obtaining of data, on which to base applications, has resulted to their mutual advantage. The user gets a greater output with less labor and investment. The manufacturer gets a satisfied customer which results in quick settlements and repeat orders, instead of unsatisfactory results with their contingent expense. The larger manufacturers have organized efficient staffs of application engineers which are being increased as conditions demand and new applications arise. These men assist the salesmen by furnishing data and often accompanying them on their visits to proposed installations. Special investigations are undertaken and the operator is assisted in selecting his equipment. Where tests are required the user and manufacturer work together and share the expense. Conferences are held with large users and their engineers. Consulting engineers find that conferences with the manufacturing engineers assist in the selection of suitable apparatus at the minimum cost.

THE NEWER ORDER OF THINGS

The broad-gage policy adopted by the manufacturers and the gradual changing of their organization has gone far toward business building. A set of specialists has been developed who understand the installation of the various kinds of apparatus. They have accumulated and classified the large amount of information which naturally comes to a manufacturing company. They have analyzed the many tests which are continually being made by such organizations, often arranging for special tests to secure valuable data. In short such an organization makes use of its every department to assist in furnishing suitable apparatus.

"The satisfied customer" has displaced previous mottoes in the electrical field. There is a spirit of coöperation between manufacturers and central-station men, and both are spending time and money to make sure that the user gets the right apparatus with the least trouble and risk. Exact engineering data are replacing guesswork. No one factor has contributed more to the advancement of the electrical industry than this accumulation of data and its commercial use by leading manufacturers. The men who represent the manufacturer are no longer mere traditional salesmen. They have a good engineering experience and know how to use available data. Where the problem is of magnitude or involves unusual features, the user, having the benefit of an engineer-specialist who has made a particular study of similar installations, can feel assured that the manufacturer will use his best knowledge to supply satisfactory apparatus and will guarantee it.

The facilities offered by manufacturers for conferences with their specialized engineers, for tests and for the use of their accumulated data by the purchaser is of considerable value to both the central station and the isolated plant. The former uses these facilities for increasing his business as well as the improvement of his plant. The benefit to the latter is still more marked. The small-plant operator must know exactly what power demands will be made upon his plant and how best to meet them. He has better assurance that his investment will be profitable and that there will be no delay in starting up his apparatus. Such coöperation reduces waste, insures continuity of service, and results in increased efficiency for all concerned.—*Electric Journal.*

Iron and Steel Imports in the Orient

The total imports of iron and steel of various sorts into all China in 1910 amounted to about $5,000,000, while the imports into the Philippines in the fiscal year ended June 30, 1911, amounted to $4,794,191, as compared with $3,305,695 worth imported in 1910. From the general course of trade it is probable that imports of steel into the Philippines for 1911 will exceed the imports into China for the same period. Of the imports of iron and steel into the Philippines the United States furnished goods to the value of $2,903,943 in the fiscal year 1911, as compared with $1,970,490 in the fiscal year 1910, while other countries furnished goods to the value of $1,890,-248 in 1911, as compared with $1,335,-205 in 1910.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.
Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1911, 1,358,200 copies. For January, 1912 (American weekly, American monthly, English weekly and German weekly), total, 92,750.

Of this issue, 19,500.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 149

American Machinist

Machine Tools and the Tariff

Last week the finance committee of the U. S. Senate gave a number of hearings to interested manufacturers on the Underwood tariff bill.

About sixty machine-tool builders appeared on Tuesday and Wednesday to protest against the putting of machine tools on the free list.

Fred Geier, president of the Cincinnati Milling Machine Co., presented the arguments for the other builders, and, we think, gave the Senators on the committee a different view of the machine-tool trade than that taken from the House.

Not a single member of the committee knew what a machine tool was; in this matter they were as well informed as the men of the House of Representatives, who framed the bill.

Most of these men thought of machine tools as the cutting tools used in tool-driving machines.

In a strict construction of language this is correct, but unfortunately the customs officials, who know no more about the matter, are deciding all the time that this and that machine, wood-working and others, are machine tools.

In this country, and in no other, it has become common usage to refer to tool machines, lathes, planers, shapers, millers, etc., as machine tools.

There is little doubt that this misconception, and the fact that more machines of this class are exported than are imported, caused machine tools to be thrown into the free list.

The machine-tool builders of this country are not altogether selfish in this matter, for they asked and got a reduction of duty on their own line of manufacture from 45 to 30 per cent. only three years ago. This was done to stop the retaliatory duties placed on our output by other nations—notably France.

There should be no separate classification of machine tools—they should be classed with machinery in general.

As this bill came from the House, it would take all protection from one line of machinery manufacturers, whose wage scale is set by other highly protected machine-making concerns.

It would open our doors to the foreign maker, who is protected in his own market.

We think very few American machine-tool builders would object to any duty, or no duty, to any country giving our machine tools the same tariff rate into their home market.

No machine should be on the free list when any of the materials entering into its construction are protected.

It is generally conceded that the tariff should be based on the difference in wages between this country and other countries.

Machinists in Germany, men employed in making machine tools, receive an average wage of between 16 and 17c. per hour. In America they receive between 26 and 27c. per hour.

The average material cost in machine tools is less than 40 per cent.—labor is more than 60 per cent.

Without a protective duty on machine tools, the American manufacturer has his choice of two things. He can go out of business or reduce wages.

The people of this country will not stand for a reduction of wages while the cost of living remains as high as it is.

And they are right.

If these statesmen want to reduce the tariff to some purpose, let them reduce it on those things men must eat and wear—then they can talk about taking it off the product of the shops that support the families of the two hundred thousand employees of the machine-tool industry.

Trade Education in Switzerland

On page 759, Volume 33, we printed an article showing that shop apprenticeship is a fundamental part of German trade training. The manual part of the trade, the use of the hands, the acquaintance with shop methods, are gotten by the German boy in the shops, in the atmosphere in which he will work as a mechanic.

Trade education has probably been carried as far in the industrial cities of eastern Switzerland as in any part of Europe. A major article in this issue describes the trade continuation school of the well known engine- and turbine-building firm of Sulzer Brothers, of Winterthur. This typical example shows the manner in which apprenticeship is viewed by the Swiss. From personal observations we can testify to the excellence of the conditions in and surrounding the school building, to the carefulness with which the boys are instructed in the shops and to the success of the entire scheme.

Switzerland is a republic and presents somewhat different social conditions from those of imperial Germany. The success of such a combination of shop apprenticeship and classroom instruction under a form of government similar to our own, should be sufficient to make us ask ourselves again if some such combination may not ultimately be the most useful in this country.

In another Swiss city, Zurich, an interesting feature of municipal supervision of the apprentices in the shops, was noted at the firm of Escher Wyss & Cie., also builders of power-plant machinery. Here the apprentices receive their shop training at the factory and attend the municipal continuation schools under prescribed regulations. However, the work in the shops is supervised by the educational authorities. At certain intervals an examiner goes to the shops and gives the apprentices an examination in shop work. This usually consists in having them make some machine part from blueprints or drawings. The quality of the work turned out determines the standing of the apprentice and also reflects upon the firm. We were told that if a machine shop fails to instruct its apprentices, so they can successfully pass these examinations, the right to have apprentices may be withdrawn. Thus, the educational authorities not only control and uphold the standard of the class-room instruction, but also the shop training.

There seems to be no opportunity to quarrel with such methods, which have for their aim the training of first-class mechanics.

Manufacturers in the Administration of Industrial Schools

We recently pointed out in these columns that manufacturers have not assumed, or been given, the leadership in directing the forces in industrial schools in the manner that has been urged by many who have carefully studied the needs of the problem. This is to be regretted.

It has been found essential in Germany that the manufacturers should exercise control over trade education, as is shown by the following quotation from the report of the Wisconsin commission, appointed to draw up plans for the extension of industrial and agricultural training in that state.

"After a very severe trial, reaching over a period of years, it was found that the inevitable tendency of all industrial schools was to become theoretical, and to turn out theoretical students rather than practical men, who will be of use in building up the industrial resources and commercial prosperity of the country. The Germans have established, almost universally, local committees of business men, manufacturers and workmen who control these schools wherever they are. The result is that the manufacturers and the working people take the utmost pride and interest in these schools and watch closely their development."

This same report points out that the tendency of full-time schools is gradually to crowd out the boy who is to earn his living at a trade, and educate for higher positions. On this point we read:

"In talking with the heads of the industrial schools in Germany one is impressed by the fact that these men always say that if the employers would only allow them to have the boys for full time, or have them for longer periods, and would not interfere so much with the management of the school, they could do splendid work. But the general history of industrial education in this country, as well as the general experience, shows us that if these schools are all put on a ful-time basis, the boy who works in the factory and earns his living after he is 14 years of age is gradually crowded out, and schools are formed which turn out engineers, professional or cultured men, but which do not meet the needs of the great mass of the people. It is far better to have the management of the schools in the hands of the employers and employees than to be hampered by the theoretical standpoint, which inevitably would result if the teachers or school men had it all in their own hands."

Long Service an Asset

It is not uncommon to be told that the workmen in a certain shop have been entirely changed during a very brief period, perhaps during a single year. Conditions are such that men are constantly coming and going.

By contrast, turn to the article on page 294, telling of the Veterans' Association of the Westinghouse Air Brake Co. Over 250 men belong to that association, and the requisite of membership is continuous service with the company for 21 years or more. That is, there are over 250 men who have been continuously in the firm's employ for periods of from 21 to 43 years. Is there another machine shop in the country that can point to a similar record?

The business success of the company needs no comment. In spite of the strong position given through patent control, permanent success could not have been had without mechanical excellence in the product. We are prepared to assert that this latter feature is directly increased by the stability of the shop personnel. Or, put a little more broadly, long service on the part of workmen is an asset to any manufacturing firm.

Every intelligent man who has worked for even six months in a shop knows something about the work being done, something that is to the direct advantage of the shop to make use of. He knows the layout of the shop and can go quickly from one place to another. He knows how the work is handled, where tools are to be found, and how to get help quickly if he needs it on some particular job. He knows how to do the particular jobs that have come to him; perhaps he has rigged up short-cuts and used them in making piece-work money. He knows a variety of things that are of value if used for the good of the shop.

This specific knowledge, however, is of no value to him in any other place, except by way of suggestion. For we seldom, if ever, see a particular job done in an identical way in different shops.

Thus this specific knowledge is an asset to the shop where it has been gotten, and to the man himself so long as he stays there. When he is discharged or leaves, the shop suffers a real loss; perhaps small in the case of any one workman, but large in the aggregate. Long service on the part of employees is an asset to the shop. For this reason it is a pity that we find so few examples of a stable working force.

International Safety Congress

An International Safety Congress is to be held in Milan, Italy, for five days, beginning May 27, 1912.

This congress, the first of its kind of international scope ever held, will be for the purpose of setting in motion a world-wide movement for the conservation of human life in industry.

The American Museum of Safety, 29 West Thirty-ninth St., is making preparations so that the United States will be well represented. An American National Committee has been selected by the American Museum to cooperate with the International body and to promote the American ideas and views at the Congress.

Personals

George Langen, works manager of the Cincinnati Planer Co., Cincinnati, Ohio, will sail Mar. 19, for an extended business trip in Europe.

Charles A. Smith, formerly general manager of the Chester Engineering and Machine Co., Chester, Penn., is now factory manager of the Lansden Co., Newark, N. J.

Frederick W. Cox, formerly assistant manager of works, Westinghouse Electric & Manufacturing Co., has become general salesman, Shewan, Tomes & Co., Hongkong, China.

Leo Loeb, until recently assistant steam engineer of the Cambria Steel Co., Johnstown, Penn., has become mechanical engineer of the U. S. Naval Engineering Experiment Station, Annapolis, Md.

Coleman B. Ross, formerly with the Linde Air Products Co., has accepted a position with the Independent Pneumatic Tool Co., and will be connected with their Pittsburg office.

Charles Booth, who has been connected with the Chicago Pneumatic Tool Co. since its organization, has been appointed district manager of the company's New England territory, with headquarters at 191 High St., Boston, Mass., vice J. M. Fowle, resigned.

G. W. Patnoe, who has been connected with Dolese & Shepard Co. for 25 years as master mechanic and superintendent, has resigned, in order to become associated with the Holran Stone Co., Cleveland, Ohio. He will take charge of their Maplegroove, Ohio, plant as general superintendent.

B. A. Brennan, recently contract manager of the Westinghouse Machine Co., and formerly with E. P. Allis Co., has been appointed sales manager of the power department of the Bethlehem Steel Co., with headquarters at South Bethlehem, Penn., in charge of gas-engine and pumping-engines sales.

C. F. Hockley, for the past three years engineer, power department, Bethlehem Steel Co., has been appointed superintendent, construction power department, Bethlehem Steel Co., with headquarters at South Bethlehem. Mr. Hockley, prior to his present association, was identified with Westinghouse Machine Co., East Pittsburg, Penn.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

Vertical Tappers

The vertical tappers shown in the illustrations have automatic stop mechanism so that they can be set to tap any desired depth.

The machine shown in Fig. 1 is designed to be operated by a hand lever

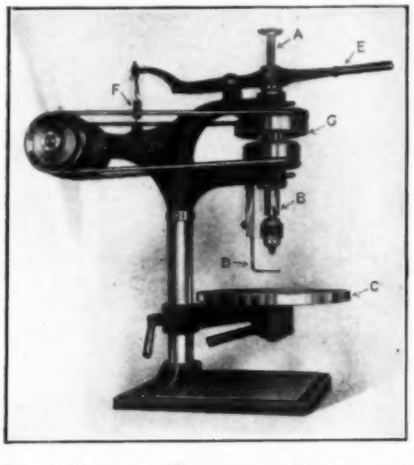


FIG. 1. VERTICAL TAPPER FOR HAND-LEVER OPERATION

and is especially adapted for gang work, and large pieces, in the handling of which the operator is obliged to stand. This machine is equipped with ball thrust bearings which are arranged to take end thrust. The machine has a range to ¼ in., and is fitted with a drill chuck to take

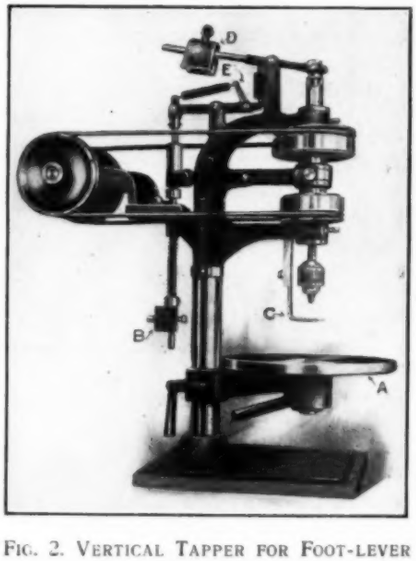


FIG. 2. VERTICAL TAPPER FOR FOOT-LEVER OPERATION

taps to that size. The base has a planed surface, 13x16 in. and the diameter of the swing table is 11½ in., with a vertical adjustment of 3 in. The clearance of the tap spindle to column is 6 in., and the net weight of the machine is 135 lb.

The machine shown in Fig. 2 is operated by foot lever, and has an adjustable belt-tightening bracket on the back of the machine as shown. This machine has the same general dimensions as that shown in Fig. 1.

Both of the machines shown are recent products of the Evans Stamping & Plating Co., Taunton, Mass.

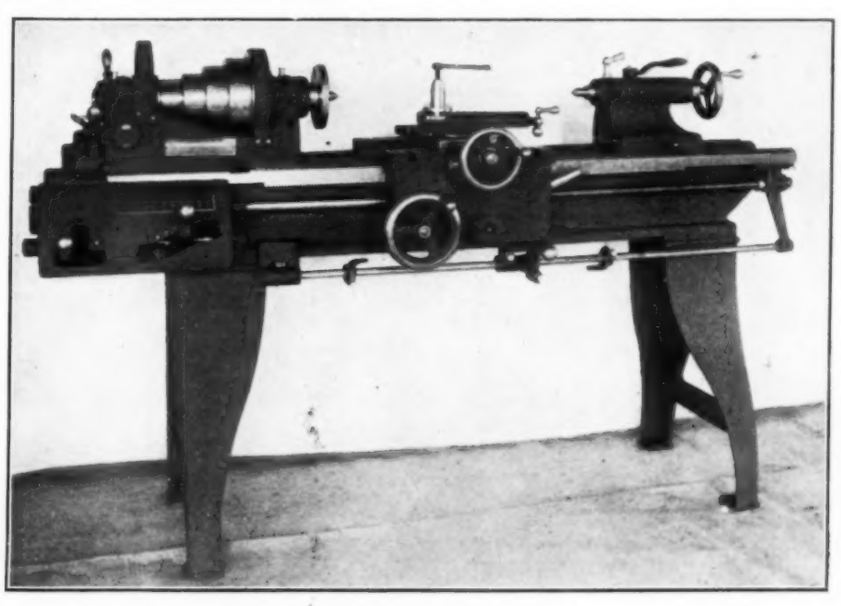
A 12-inch Quick Change Lathe

The halftone shows a 12-in. quick-change lathe built by the Seneca Falls Manufacturing Co., Seneca Falls, N. Y.

This quick-change feed mechanism consists of a cone of eight steel gears, located on the lead screw in the right-hand side of the feed cage; connection with any one of the eight gears is made by tumbler yoke and gears from the lower shaft, which is given three changes of speed through another tumbler and set of gears in the left end of the cage. By means of the lever on the end of the headstock two different speeds are imparted to the set of gears in the left end of the cage, and give the lead screw, which is also used as a feed rod, 48 changes. All standard threads from 1½ to 92 per inch, including 11½, and feeds of 0.0023 to 0.142 inch per revolution of head spindle are given instantly and obtained.

The micrometer stop for the cross-slide was shown and described at page 1037, Vol. 33, Part 2. The graduations are about ⅛ in. apart and read in 0.00025 in. The stop mechanism is thrown in and out of engagement by pushing in and out the knob inside of the handwheel. It is positive and capable of cutting accurately to a given depth for both outside and inside work. The depth of cut cannot be varied by crowding the tool and the stop may be used with taper attachment.

The reverse mechanism for both cross and longitudinal feeds and lead screw consists of a set of spur gears and clutch in the headstock, operated through levers connected by a reversing rod to the hand lever on the apron. It does away with the reverse belt on the countershaft and gives 16 forward speeds to the head spindle. An automatic stop device for the carriage operates in either direction, by means of adjustable stops on the reverse rod, and may be used when cutting threads.



A 12-IN. QUICK-CHANGE LATHE

A draw-in chuck with collets up to ¾ inch can be furnished. The cone is of large diameters for 2-inch belt. The carriage is wide with full length, solid bearings on V ways. A new binding device secures the plain and compound rests to cross-slide. Felt wipers clean the ways of dirt and spread oil. All carriages are arranged for taper attachment which may be affixed at any time. The crossfeed screw has a large collar graduated to read in thousandths.

An automatic safety device precludes the possibility of engaging opposing feeds; one automatically disengages when another is thrown in. The feed gearing is disengaged when cutting threads, and the longitudinal handwheel does not revolve. The countershaft has improved friction pulleys with a large friction surface on the rim of the pulley. Wear on the friction parts has been eliminated when the pulley is running idle. Extra large hubs give large wearing surfaces on the shaft, and the pulleys may be oiled without throwing off the belts.

Universal Spiral Gear Hobber

A universal spiral gear hobber is shown in Fig. 1. It is adapted to cut spur and spiral gears, wormwheels and worms, up to 24-in. diameters, 3 pitch in cast iron, 3½ pitch in steel, and is built by the Adams Co., Dubuque, Iowa.

It can be arranged to cut a single-thread worm or a screw of fine pitch and from that on up through all pitches and number of teeth of worm, spiral and spur gears, including all prime numbers up to over a thousand.

The vertical feeds of the cutter head range from 0.002 to 0.500 in. per revolution of the table. The table may be geared to make one revolution to two revolutions of the cutter, or it may be geared to make one revolution to a thousand or more revolutions of the cutter.

This exceedingly wide range of feeds and table speeds is, of course, unnecessary for ordinary spur-, spiral- and worm-gear cutting but no additional complication was resorted to, to obtain it. The compounding of a comparatively small number of moderate-size gears enables this range to be had.

The machine is especially designed for gear and worm hobbing, but the slow table travel obtainable, relative to the cutter speed, enables the machine to be used also as a continuous miller, as shown in Fig. 4. A special spindle and bracket may be had for this purpose. Unusual weight and width of saddle and swivel are provided to increase the rigidity.

The cutter spindle is large and has a hole through which the arbor proper passes, and is driven by a long key and feather. Adjusting nuts on the arbor at each end of the spindle provide for end adjustment of the hob to facilitate setting one tooth central and to shift to a new cutting position.

The spindle is driven by a steel spur gear and pinion, and both spindle and pinion shaft run in adjustable bronze bearings on each side of the gears, thus equalizing the stress. There is but one pair of bevel gears in the spindle drive train, no long splined shaft and sliding key being used in the drive.

A reducing gear of large diameter is interposed between the cone-pulley shaft and a universal-joint shaft which transmits power to the spindle. The universal joints are of special design with large wearing surfaces of steel on bronze, have ready means to compensate for wear, and have felt oil-retaining pads to facilitate lubrication.

The cutter head has a vertical power feed ranging from 0.002 to 0.5 in. to each revolution of the table. An automatic stop and a rapid power return are provided. The table saddle has a power cutting feed ranging from 0.00025 to 0.375 in. to each revolution of table. An automatic depth-stop is provided for wormwheel hobbing. A regular set of change gears, 120 in number, will give all the feeds mentioned and all spacings up to 200 and many above. Special gears

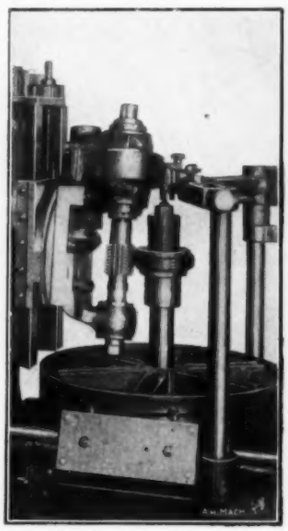


FIG. 2. HOBBING A SPIRAL GEAR

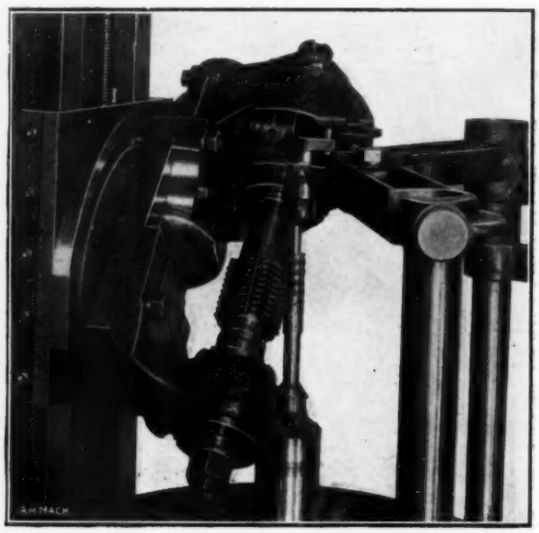


FIG. 3. HOBBING A STEEP WORM

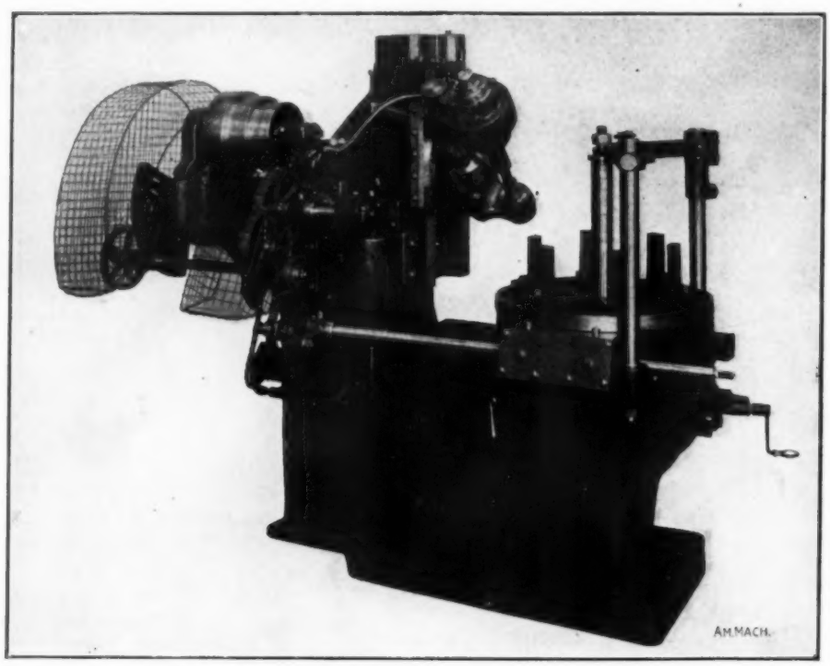


FIG. 1. FARWELL UNIVERSAL SPIRAL-GEAR HOBBER

can be furnished to cut all other numbers including all prime numbers.

The countershaft has three clutch pulleys which provide a hobbing speed in both directions and a slow speed used for driving milling cutters such as shown in Fig. 4. The lubricating pump is arranged to be run in the right direction when the direction of the spindle is reversed. The table is driven by a steel worm engaging a bronze ring wormwheel. This wormwheel in 20 in. in diameter.

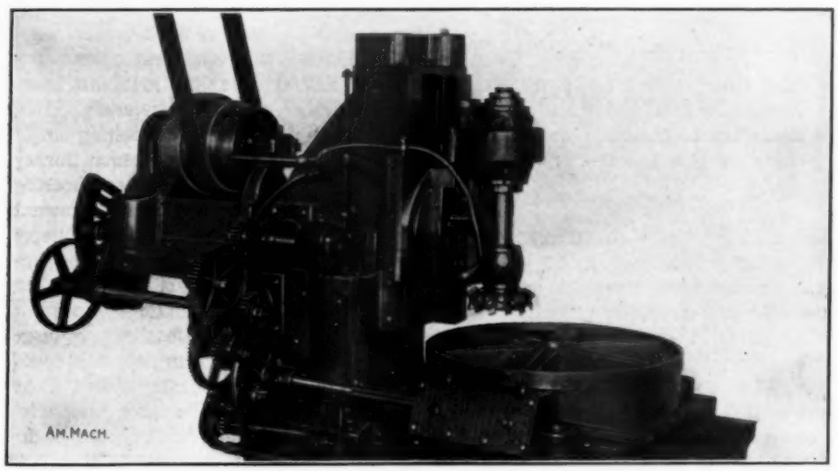


FIG. 4. THE HOBBER USED AS A CONTINUOUS MILLER

Provision is made for easily taking up any wear either in the mesh or end motion of the worm. The table is of heavy rib and rim construction, but the top between the ribs instead of being level is depressed conically with a hole in the center which conducts all cuttings and lubricant into a pan in the base of the machine. The lubricant drains out of the pan into a tank below. The pan may be easily removed through the door and the contents dumped, handles being provided for this purpose. The weight of the machine complete is about 3900 lb.

Frahm Vibrating Reed Tachometers

The indicating part of the Frahm vibration tachometer, made by Siemens & Halske, Berlin, Germany, and put on the American market by James G. Biddle, Philadelphia, Penn., consists of one row or more of tuned steel springs firmly supported at one end, side by side, as is shown in Fig. 2. The common support is mounted on the base of the instrument case. The springs or reeds are made from the best steel usually about 3 mm. in width, and a small portion of the free end is bent over at right angles. This part of the spring is enameled white so that it can be easily seen.

The operation of the tachometer depends upon the fact that in every machine there are some slight inequalities in the weight of the revolving parts, so that when they are in motion a certain amount of vibration is set up. The tachometer is mounted directly upon the base or cover of the machine, so that it will vibrate in unison with it. This being the case, the reed, which is in tune with the vibrations of the machine, is set into violent vibration, so that it can be easily distinguished from its neighbors. For example, if the machine gives one impulse at each revolution, at 2000 r.p.m. that reed would indicate which is adjusted to 2000 vibrations per minute. In this way the instrument indicates the speed of the machine it is attached to very accurately, and there are no electrical or mechanical connections to become deranged through accident or wear.

FIG. 1. THE FRAHM VIBRATING REED TACHOMETER

This type of tachometer is especially well adapted for steam turbines, pelton wheels, ventilators, centrifugal pumps and electric motors, etc. It is best suited for ranges from 900 to 8000 r.p.m. For ranges above or below these limits, special arrangements must be made in accordance with each individual case.

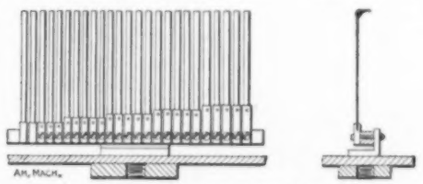


FIG. 2. ROW OF REEDS IN VIBRATION TACHOMETER

Lock for Grease or Oil Cup Tops

The F. S. & G. L. Brown Machine Co., Baltimore, Md., is putting a lock on the top of the oil cups used on an automobile starter made by them, which effectually prevents the top from jarring off, but at the same time allows it to be easily unscrewed by hand.

LOCK FOR GREASE- AND OIL-CUP TOPS

The lock, as the illustration shows, is simply a piece of spring wire set crosswise in the top; it is fastened at one end and so placed as to easily spring down into a slot cut in the rim of the cup as the top is screwed home.

Geared Sprue Cutter

The accompanying illustration shows a style of geared sprue cutter recently designed and built by the George Whiting Co., Chicago, Ill.

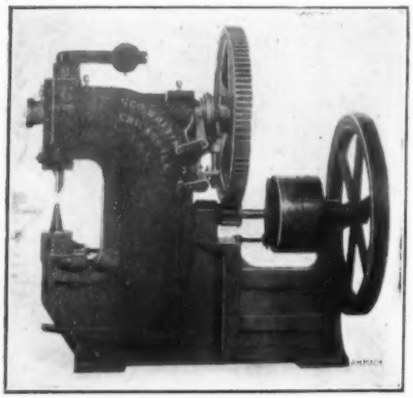
The knives shown are those used for cutting off risers, gates and sprues up to the capacity of the machine, but when desired an extra pair of cutters is furnished for cutting off light fins from steel castings. These are so made that the knives will come as close to the casting proper as it is possible to cut with the machine. The knives can be set to cut either way.

The machine is fitted with an automatic stop and arranged with tight and loose pulleys, having a substantial belt shifter. The flywheel is crowned for a belt from the motor. Provision is made on the backstand for direct-connecting a motor which can be set on a bracket attached thereto.

The machine is made in different capacities, and in the geared type runs about

30 strokes per minute, but if desired, it can be fitted with a flywheel and run at a rate of 90 strokes per minute.

It is actuated by a pintle movement, having a cast-steel pintle bushed with



GEARED SPRUE CUTTER

phosphor-bronze, and an adjustment is provided on the lower block, which holds the cutter, for lining it up with the top knife so as to cut accurately. A bar head is furnished on the end of the machine for pulling down the head and lining up the top cutter to see that it is in the proper position, or to enable the operator to make an accurate cut when trimming castings by permitting him to pull the cutter down to the exact point he wishes to shear before starting the machine.

Sheet Metal Standards of the S. A. E.

NOTES FOR USE IN MAKING CALCULATIONS

The following data figures showing tensile strength and elongation, recently offered to the Society of Automobile Engineers by their Standards Committee, are approximate calculations and were intended as a guide only.

If the figures are of particular interest to an engineer, a special inquiry should be sent to the mill manufacturing, giving size, temper, etc., with a request for tensile strength and elongation figures covering the particular requirements.

SPECIFICATION NO. 33

Standard Sheet Brass for Use in the Manufacture of Lamps, Horns, Flexible Tubes, and Ornamental Work in General—Tensile strength, hard, about 60,000 lb. per square inch; elongation, about 5 per cent. in 2 in. Tensile strength, soft, about 48,000 lb. per square inch; elongation, about 50 per cent. in 2 in. Drawing brass and spinning brass are special qualities of brass for the operations indicated by the name.

SPECIFICATION NO. 34

Low Brass—Used on account of color, resistance to corrosion and atmospheric conditions, and on account of superior ductility. Tensile strength, hard, about 75,000 lb. per square inch; elongation, about 5 per cent. in 2 in. Tensile strength, soft, about 42,000 lb. per square inch; elongation, about 50 per cent. in 2 in.

SPECIFICATION NO. 35

Brazing Brass—Used for parts where brazing or silver soldering is required. This material has about the same physical properties as low brass.

SPECIFICATION NO. 36

Free-cutting Brass—Used for small parts to be milled or turned; also for brass plates which must be sawed to shape. It has a tensile strength when hard of about 75,000 lb. per square inch, with an elongation of about 3 per cent. in 2 in. When soft, its tensile strength is about 50,000 lb. per square inch, with an elongation of about 35 per cent. in 2 in.

SPECIFICATION NO. 37

Red Metal, Commercial Bronze—Has a rich gold color and is used for screen wires, radiators and in other places subject to corrosion. It is also used for ornamental parts where its color is desired. Its tensile strength, hard, is about 55,000 lb. per square inch, with an elongation of about 5 per cent. in 2 in. Soft, it has a tensile strength of about 37,000 lb. per square inch, and an elongation of about 40 per cent. in 2 in.

SPECIFICATION NO. 38

Gilding Metal—This material is used for radiators. It has a tensile strength of about 45,000 to 55,000 lb. per square inch, with an elongation of about 5 per cent. in 2 in. when hard. Annealed soft its tensile strength is about 35,000 lb. per square inch, with an elongation of about 35 per cent. in 2 in.

SPECIFICATION NO 39

Brass Rod for Cold Heading—Has a tensile strength of about 35,000 to 40,000 lb. per square inch, with an elongation of about 50 per cent. in 2 in.

SPECIFICATION NO. 40

Free-Cutting Brass Rod—This material is suitable for automatic screw-machine work. Its tensile strength is about 65,000 lb. per square inch, with about 15 per cent. elongation in 2 in.

Valuable Engineering Journals

BY J. A. M. ROBINSON

A full appreciation of the value of engineering journals and magazines can be obtained from a study of their purpose. Because a long article describing the products or manufacturing process of some company is sometimes published, it is occasionally thought that the object of the paper is advertising. But the real aim of most engineering papers is to furnish a medium through which useful and interesting knowledge belonging to the profession may be made public.

Most engineering practice is empirical. The degree of success of a project may be predicted with considerable accuracy if a similar scheme has met with success a number of times previously. This is the reason why the consulting engineer's office contains a reference library largely made up of current engineering literature. Here the engineering journal is of great value. It may be of value to the student in a similar way if the important and interesting articles are taken care of in some systematic manner.

The engineering profession at large would be extremely fortunate if it could believe all the statements made in its current literature. The fact that misstatements are made is not always the fault of the paper; sometimes it is. It is needless to say that a paper whose articles cannot be relied upon is worthless. It is well to avoid those papers which appeal to the popular imagination as, in order to make glowing statements, the truth is often distorted beyond recognition. Herein lies the strong point of the strictly engineering article; facts are set forth in the fewest possible words consistent with clear meaning, and rightly so, for the simple statement is worth the most.

One cannot read all the papers belonging to his chosen branch of the profession; he cannot carry too much ballast, else he sink. To get the most from his reading—for, after all, the benefit derived therefrom depends upon himself—he should read the best articles in the best papers treating of his branch of engineering, and read them thoroughly.

There are two quite distinct processes used for macerating peat without special machinery: First, that in which enough water is added to the peat before it is macerated to make it into a soft paste, which, after treatment, is often decidedly liquid. This pulp is usually formed into bricks after it is spread on the drying ground. The forming is done either by hand, whence the name hand turf sometimes given the product, or by turning the pulp into molds. Less often the macerated peat is spread in a layer on the drying ground and cut into the required shape with special tools, the bricks separating through contraction as they dry. Peat is partly decomposed and disintegrated vegetable matter that has accumulated in any place where the ordinary decay or chemical decomposition of such material has been more or less suspended, although the form and a considerable part of the structure of the plant organs are more or less destroyed.

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

For the convenience of readers, news items in this department will hereafter be arranged geographically, by states. The various states will be grouped under subheads, as follows:

New England: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.

Middle Atlantic: New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia.

Southern: Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Tennessee, Kentucky.

Middle West: Ohio, Indiana, Michigan, Illinois, Wisconsin.

West of the Mississippi: Iowa, Minnesota, Kansas, Nebraska, South Dakota, North Dakota, Wyoming, Colorado, Montana, Missouri, Arkansas, Texas, Oklahoma, New Mexico.

Western States: Idaho, Utah, Nevada, Arizona, Washington, Oregon, California.

Metal Working

NEW ENGLAND

The large blacksmith shop of F. H. Davis has been destroyed by fire, at Lisbon Falls, Maine. Loss, $3000.

Part of the foundry owned by R. Estabrook Sons, West First and C Sts., Boston, Mass., was damaged by fire, Feb. 7. Loss, $3500.

The Henley-Kimball Co., Boston, Mass., has opened a new repair shop and service depot, in Cambridge, Mass.

The Worcester Pressed Steel Co., Greendale, Mass., will add a large rolling mill to its present plant.

Arthur Johnston, Milton, Mass., will have a large private garage erected, on Centre St.

The General Electric Co., Pittsfield, Mass., is planning to erect a machine shop and storehouse, on Tyler St., to cost $100,000.

The foundry of the General Electric Co., Pittsfield, Mass., has been damaged by an explosion to the extent of $25,000.

Fire caused $15,000 damage to the plant of the Auto Metal Co., Springfield, Mass.

The Moore Drop Forging Co., Birnie Ave., Springfield, Mass., will erect a one-story factory, 70x115 ft., of mill construction.

The contract for the new storehouse and garage to be erected on Bond St., Springfield, Mass., for E. A. Dexter, has been awarded to the A. E. Stephens Co., 25 East 26th St., New York, N. Y. The storehouse will be 100x114 ft., four stories and basement. The garage will be 66x112 ft., one story high.

The Dart Manufacturing Co., Waterloo, Iowa, contemplates removing its plant to Worcester, Mass. The company manufactures a light auto delivery truck.

The Brown & Sharpe Manufacturing Co., Providence, R. I., manufacturer of fine tools, etc., is increasing its capacity by the addition of another brick building, now nearing completion, adjoining its present plant.

The C. G. Garragus Machine Co., Riverside Ave., Bristol, Conn., has let a contract for an addition to its factory. It will be three stories high, 25x40 ft., with a brick extension, 22x46 ft., 20 ft. high, for a boiler room. Noted Feb. 1.

Work has been started on a new foundry to be erected by the Dairy Machinery & Construction Co., Derby, Conn. It will be of steel and concrete. The main building will also be carried up an additional story.

W. W. Richards, 41 West Fifty-ninth St., New York, will build a garage, 41x35 ft., two stories high, at Greenwich, Conn. Estimated cost, about $6000.

S. F. Hines will erect a new garage on Wethersfield Ave., Hartford, Conn. It will be of brick, 30x64 ft., one story high. Burton A. Sellew is architect.

An explosion partially destroyed the garage and repair shop of the Meriden Auto Station, West Main St., Meriden, Conn.

The building at 27 Artizan St., New Haven, Conn., occupied by the New Haven Pattern Model Works and the Lounsbury & Reilly Machine Works, was damaged by fire, Feb. 9.

The William Ritchie Co. is building a brick machine shop at the plant of the Acme Wire Co., on Whitney Ave., New Haven, Conn. The building will be one story high, 20x30 ft.

James McLay, Grand Ave., New Haven, Conn., is having plans drawn for a garage. The structure will be two stories high, 100x40 ft., of brick, stone and concrete. R. A. D'Avino is architect.

MIDDLE ATLANTIC STATES

Fire has destroyed the plant of Glantz & Johnson, brass founders, Jamestown, N. Y. Loss, $5000. The plant will be rebuilt.

The machine shop, engine room, stone crushers and molding department of the Jamestown Shale Paving Brick Co., Jamestown, N. Y., were damaged by fire, Feb. 5. Loss, $75,000.

The A. L. Sweet Iron Works, Medina, N. Y., are planning to build a new and larger foundry.

The plant of the Case Bros. Cutlery Co., Little Valley, N. Y., has been totally destroyed by fire. Loss, $70,000.

S. A. Guttenburg, architect, Post Office Building, Mount Vernon, N. Y., is preparing plans for the erection of a garage, 34x130 ft., at Mount Vernon. Estimated cost, $6000.

Fire damaged the buildings at 52, 54, 56 and 58 Vesey St., New York, N. Y., on Feb. 12. The buildings were occupied in part by the Lowe Electric Co., Rathbun & Co., machinists, and Morris Wertzman, bicycles and repairs. Total loss, $250,000.

The North Buffalo Hardware Foundry, North Buffalo, N. Y., is building a new plant, 65x250 ft.

The plant of the Acme Gas Fixture Co., at Bridgeton, N. J., was destroyed by fire, Feb. 12. Loss, $60,000. Insurance, $15,000. The company will rebuild.

The Eagan-Rogers Steel & Iron Co., recently incorporated, with a capital of $100,000, will erect an iron and steel casting plant, near Chester, Penn. The new plant will be completed about Mar. 1.

The Ajax Metal Co., 46 Richmond St., Philadelphia, Penn., has purchased 20 acres at Orthodox St. and the Delaware River, on which the company will erect several factory buildings.

Plans are being prepared by J. C. Fern, architect, 5533 Wyalusing Ave., Philadelphia, Penn., for the construction of a one-story garage, 50x100 ft., for Charles H. Clark. Estimated cost, $10,000.

The Struthers-Wells Engine Co., Warren, Penn., will build an addition to its boiler shop, to cost between $60,000 and $70,000.

New shops, to cost $3,000,000, will be erected, at Cumberland, Md., by the Baltimore & Ohio R.R. Co.

Bids are asked until 10:30 a.m., Mar. 8, by Maj. F. C. Boggs, Corps Engineers, United States Army, general purchasing officer, Isthmian Canal Commission, Washington, D. C., for motors, centrifugal pumps, float switches and pump-motor starters for the Panama Canal locks and spillways.

SOUTHERN STATES

The Atlanta Steel Co., Atlanta, Ga., proposes to spend $300,000 to double the capacity of its plant. An openhearth furnace and a billet mill will be built.

Fire totally destroyed the machine building of Savannah Cooperage Co., on Savannah River, about two miles from Savannah, Ga., Feb. 11. The loss, $25,000, is partially covered by insurance.

The United States Cast Iron Pipe & Foundry Co. will improve its plant, at Bessemer, Ala., at a cost of about $150,000. Contract is held by Riter & Conley, of Pittsburg, Penn.

The plant of the Central City Foundry & Machine Co., owned by E. B. Miller, Central City, Ky., was destroyed by fire, Feb. 5. Loss, $10,000, covered by insurance.

MIDDLE WEST

The Transue & Williams Co.'s drop forging plant, at Alliance, Ohio, has been destroyed by an explosion and fire.

The Universal Machine Co., Toledo, Ohio, will move to Bowling Green, Ohio, where it will engage in the manufacture of auto parts. A new factory has been completed.

The Ohio Blower Co., Cleveland, Ohio, will build a new shop on Ivanhoe Road. It will be two stories high and cost about $30,000.

The G. S. Kuhlman Car Co., Collinwood, Ohio, makers of street cars, will soon resume work. The plant will be enlarged.

A two-story garage will be erected by J. G. Jennings, at Cleveland, Ohio. Bohnard & Parson, 509 Chamber of Commerce Bldg., Cleveland, are the architects.

The Ferro Machine & Foundry Co., Cleveland, Ohio, manufacturer of marine engines, will erect an addition to its plant, at East Sixty-sixth St. and Hubbard Ave.

The Anderson Tool Co., whose plant at Anderson, Ind., was recently destroyed by fire, will move its business to Hamilton, Ohio. C. W. Hoover, Anderson, Ind., is manager.

A loss of $60,000 was caused by a fire which destroyed the plant of the Oliver Foundry & Machine Co., Ironton, Ohio.

The city of Lakewood, Ohio, is asking for bids for automobile fire-fighting apparatus. J. H. Brown is director of public safety.

The Louisville & Nashville R.R. Co. will spend $200,000 for improvements on the Evansville, Ind., shops and yards. J. E. Willoughby is engineer of construction, Louisville, Ky.

The Rybolt Heating Co., Indianapolis, Ind., will install elevator equipment in its plant.

The Nordyke & Marmon Co., automobile manufacturers, Indianapolis, Ind., will install more elevator equipment in its plant.

The wood-working and metal-working shops of the Interlaken School, at Silver Lake, near Laporte, Ind., were completely destroyed by fire, Feb. 9.

Plans are being prepared for a two-story foundry, at Battle Creek, Mich., for the Union Steam Pump Co. Estimated cost, $30,000. Bids will be asked in the spring. C. E. Kolb, Jefferson and Noble Sts., Battle Creek, is president.

Plans are being prepared by Smith, Hinchman & Grylls, 710 Washington Arcade Bldg., Detroit, Mich., for the erection of a two-story iron foundry, 90x305 ft., for Nicholas & Shephard, Battle Creek, Mich. Estimated cost, $70,000.

Plans are being prepared for rebuilding the drop-forging plant of the Detroit Forging Co., 120 Mount Elliot Ave., Detroit, Mich., recently destroyed by fire. Estimated cost, $25,000. Hugo Scherer is president. Noted Feb. 8.

The Saranac Machine Co., St. Joseph, Mich., manufacturers of paper-box machinery, will build a new plant in the spring.

The engine and boiler houses of North Breeze Coal & Mining Co., at Breese, Ill., were destroyed by fire, on Feb. 5. Loss, $50,000, covered by insurance.

A four-story brick garage will be erected on Michigan Ave., Chicago, Ill., for James Cunningham, Son & Co., 557 Wabash Ave., Chicago. Estimated cost, $60,000.

The plant of the Barnard & Leas Manufacturing Co., at Moline, Ill., was destroyed by fire, Feb. 6. The company manufactures flour-milling machinery. Loss, $500,000.

The Kendall-Friday Co., Peoria, Ill., will engage in the manufacture of gasoline engines.

The International Hoist Co., Antigo, Wis., is considering enlarging its plant. The company manufactures cranes, hoists, gasoline engines, etc.

WEST OF THE MISSISSIPPI

William Bros. and R. Polson are planning to erect a roller mill, at Pleasantville, Iowa.

W. A. Wells, St. Paul, Minn., has awarded a contract to Cameron & Co., St. Paul, for the erection of a two-story garage, 90x100 ft., to be occupied by the White Bear Auto Co. Ellerbe & Round, Endicott Bldg., are the architects.

The machine shop of W. M. Watts & Son, Center, Tex., was destroyed by fire, Feb. 8.

The foundry and machine shop of McNey & Duff, Terrell, Tex., will be moved to Temple, Tex.

The factory of the Timpson Spoke & Handle Co., at Timpson, Tex., was destroyed by fire, Feb. 3.

The Atchison, Topeka & Santa Fé Ry. Co. has begun reconstruction of its shops, at Clovis, N. M. J. Purcell is superintendent of shops, Topeka, Kan.

WESTERN STATES

Plans are being prepared for a 3000-ton smelter for the United Verde Copper Co., Jerome, Ariz.

The Southern Pacific Co. is planning to rebuild the machine shops at Tucson, Ariz. C. T. Noyes, Sacramento, Calif., is superintendent of shops. The work will cost $300,000.

The Read Manufacturing Co., Davis, Calif., will build new machine shops, which will be fully equipped. J. J. Trumpeter is manager.

H. E. & William Bates and A. C. Hardy, Santa Barbara, Calif., plan to build large machine shops at Fillmore, Calif.

The California Art Steel Ceiling Co., Los Angeles, Calif., contemplates the erection of a plant, on Santa Fé Ave., for the manufacture of its specialties.

A branch factory, to cost $300,000, will be erected at Los Angeles, Calif., by the Ford Motor Co., Detroit, Mich. The main building will be of reinforced concrete, four stories, 150x500 ft.

William McKinnon, Oakland, Calif., will erect a new commercial garage and machine shop, on San Pablo Ave., Oakland. Modern machinery will be installed.

The Amalgamated Motors Co., Santa Ana, Calif., has commissioned the Alhambra Construction Co., Alhambra, to prepare plans for the construction of a factory building, 150x350 ft.

CANADA

The Goldie & McCulloch Co.'s boiler shop at Galt, Ont., will be enlarged.

The factory of the Owen Sound Wire Fence Co., Owen Sound, Ont., was damaged by fire, Feb. 11, and the weaving machinery totally destroyed. Loss, $3000.

The workshop of the Electrical Maintenance Co., 162 Adelaide St., Toronto, Ont., was partly destroyed by fire.

A firm to be known as the Differential Axles Co., Ltd., has been formed, at Toronto, Ont., with a capital of $2,000,000. Factory headquarters will be erected at Toronto. The firm will manufacture general traffic and conveyance equipment for steam and electric railways.

The plant of the Winnipeg Steel Culvert & Granary Co., Winnipeg, Man., has been destroyed by fire.

The Atikokan Iron Co., Vancouver, B. C., plans to erect an iron and steel plant at Vancouver. Estimated cost, $5,000,000.

Westinghouse, Church, Kerr & Co., 10 Bridge St., New York, N. Y., have been retained by the Canadian Pacific Ry. as engineers and constructors in connection with improvements and additions at Calgary, Alta. The work includes the design and construction of shops comprising locomotive erecting shop, machine shop, blacksmith shop, boiler shop, tender shop, foundry, planing mill, power house, pattern shop, coach-repair and paint shop, freight-car repair shop, store room and office building, oil house and numerous smaller buildings and structures, such as mess building, dry kiln, scrap docks and material bins. The erecting shop will be of the transverse lift-over type and will contain 35 bays. The machine shop for heavy machine tools will be located parallel to and adjoining the erecting shop on one side and space will be provided for another machine shop to contain lighter tools. The blacksmith shop will be located parallel to and adjoining the erecting shop, but on the opposite side to the machine shop, and will afford ample space for heavy forging work, steam hammers, etc. Adjoining the end of the blacksmith shop and parallel to the erecting shop will be the boiler shop next to the high bay of which space is provided for flue shop, boiler-shop tools and a flue rattler. In general, the construction will be of concrete steel, brick, or hollow tile, depending on conditions as yet undetermined. The work will also include the design and installation of the service equipment in the various buildings, including traveling and jib cranes, wiring system for shop and yard lighting and power, air and steam piping systems for power and heating purposes, water supply for drinking and fire protection, plumbing and toilet facilities, drainage system, transfer tables and pits, coal and ash-handling equipment, necessary switchboard and transformer substations. J. C. Sullivan, chief engineer Canadian Pacific Ry. Co., western lines, Winnipeg, Man., is in charge of the work.

General Manufacturing

NEW ENGLAND

The wood-working shop of E. Wilbur French, Franklin, N. H., was destroyed by fire, Feb. 7. Loss, $4000.

W. A. Brown has purchased the large wood-working plant of W. A. Choate, at Wilmington, Vt., and intends to increase the output of the plant.

The plant of M. J. Freedman & Co., Beach St., Boston, Mass., was badly damaged by fire. Loss, $15,000.

The factory of the Lane Shoe Co., 3 Sterling Pl., Brooklyn, N. Y., was damaged by fire, Feb. 10.

The satinette mill of Mann & Stevens, East Brookfield, Mass., was recently destroyed by fire, causing a loss of $10,000.

The West Boylston Manufacturing Co., Easthampton, Mass., will soon begin the erection of two factories, four stories high, 117x326 ft., and 140x120 ft.

Fire destroyed the No. 3 mill of the Mann & Stevens Woolen Co., North

Brookfield, Mass., causing a loss of $8000.

Holyoke, Mass., contemplates issuing $140,000 bonds for improvements to its municipal gas and electric-light plant.

Pittsfield, Mass., will expend $70,000 for the extension of its water system.

Equipment is needed for the newly completed power house at the Textile School, Lowell, Mass.

The J. B. Cover Co., Lowell, Mass., is erecting a grain elevator.

The Daggett Box Shop, Lowell, Mass., which has been closed for two months, will be reopened under new management.

Lockwood, Green & Co., architects, Boston, Mass., have been asked to prepare plans for a new factory building to be erected at Greendale, Mass., for the Whitney Manufacturing Co.

Plans are being completed for a new building to be erected at Linden and Cass Sts., Springfield, Mass., for Tait Bros. It will be 40x162 ft., two stories, of brick, and will be used for a milk depot.

J. F. McWilliam will erect a commercial garage at 1147 Main St., Worcester, Mass., to cost $7000.

The dry house of the Sylvester Tower Piano Action Co., 145 Broadway, Cambridge, Mass., was damaged by fire, Feb. 7 Approximate loss, $5000.

The Wolff Worsted Mills, Harrisville, R. I., are increasing the capacity of their plant by additional new machinery.

The Barrington Brick Co., Barrington, R. I., has been organized, and will acquire the plant of the New England Brick Co.

The United Raincoat Co., Norwalk, Conn., has leased a plant in that city and will install machinery.

The Dairy Machinery & Construction Co., Derby, Conn., has purchased land and will build an addition to its plant.

The Rapkins Brewing Co., Hartford, Conn., is to have a large cold-storage plant erected.

W. H. Ross, Division St., Springfield, Mass., contemplates the erection of a large grain elevator on Hampden St.

Work has been started on an addition to the Domestic Laundry on Hanover St., Stamford, Conn. The building will be 50x65 ft., two stories high, of brick and concrete construction.

The Trumbull Electric Manufacturing Co., Plainville, Conn., is contemplating erecting a large addition to its plant.

The Boone Folding Box & Printing Co., Bridgeport, Conn., will erect, in the spring, a new building.

The Beaton & Corbin Manufacturing Co., Southington, Conn., is to add a two-story building to its plant.

The American Silver Co., Bristol, Conn., has announced its intention to build an addition to the factory on Main St. The addition will be of brick, two stories high, 50x36 ft.

MIDDLE ATLANTIC STATES

The plant of the Chadakoin Boat Co., recently burned, at Celoron, N. Y., will be rebuilt.

The Gibert Knitting Co., Little Falls, N. Y., is preparing plans for the erection of two additional buildings to its plant on Main St.

A two-story addition, 43x78 ft., will be built by the Little Falls Felt Shoe Co., Little Falls, N. Y., to its factory at Sixth and John Sts.

The Frontier Tire & Rubber Co., Buffalo, N. Y., has been incorporated for the purpose of manufacturing rubber tires. New machinery will be needed. The company's offices are at Mazara St. and West Delavan Ave. Charles F. Benzing is president.

The three-story factory at 289-293 Greenpoint Ave., Brooklyn, N. Y., was damaged by fire, Feb. 10. The building is occupied by the J. H. Miller Wood Planing Co., the Peter Goodman Sash & Molding Mills, and the Empire Molding Mill Co. Loss, $40,000.

The plant of the Bingham Trunk Co., Lower Terrace, Buffalo, N. Y., was destroyed by fire, Feb. 12. Loss, $150,000.

The J. L. Schwartz Brewing Co., Buffalo, N. Y., will build a bottling and refrigerating plant to cost $50,000.

The Central Casket Co. is erecting a new plant, two stories high, 75x150 ft. in Buffalo, N. Y.

The Sterling Furniture Co., Salamanca, N. Y., will construct a four-story building in the spring.

The saw, feed and grist mill owned by D. H. Parshall, Hornell, N. Y., was destroyed by fire, Feb. 6. Loss, $6000, with no insurance.

The building, machinery and stock of the American Sugar Refining Co., of New York, at H. & E. plant No. 2, South Second and Third Sts., Brooklyn, was damaged by fire on Feb. 8.

The Hoefler Ice Cream Co., Buffalo, N. Y., is having plans prepared for the construction of a one-story addition, 50x150 ft., to its factory at 296 Connecticut St. The estimated cost is $250,000.

The plant of the Greenwood Pottery Co., at Trenton, N. J., was damaged by fire, Feb. 12. Loss, $50,000, covered by insurance.

The five-story brick furniture factory of the Shoemaker Co., at Third and Willow Sts., Philadelphia, Penn., was damaged by fire, Feb. 10. Loss, $5000.

The three-story brick building at 51 Carson St., Pittsburg, Penn., was destroyed by fire, Feb. 10. The building was occupied by the Pittsburg Barrel & Cooperage Co. Loss, $7000.

Fire resulting in a loss of about $3000 damaged the shirtwaist factory of Lezey & Blanck Brothers, Orthodox and Race Sts., Frankford, Penn., on Feb. 12.

The main building of the Beaver Falls Planing Mill Co., Beaver Falls, Penn., was recently destroyed by fire, at a loss of $75,000.

The International Window Manufacturing Co., Scranton, Penn., has built a large factory to make a new type of the double-sash window.

The contract for a $20,000 addition to the factory of the Ebert Furniture Co., Sixth and Moore Sts., Philadelphia, Penn., planned by Ballinger & Perrot, has been let to Appleton & Burrell.

Day & Zimmerman have procured a permit for the erection of a factory building, at Front St. and Erie Ave., Philadelphia, Penn., which will cost $100,000. The new structure will be two stories high, 203x218 ft., of reinforced-concrete and brick construction.

The Zell plant of the American Agricultural & Chemical Co., Baltimore, Md., has been leased by the D. B. Martin Co., and will be used as an addition plant for the manufacture of fertilizer.

Machinery, in the Baltimore Asbestos Manufacturing Co., Baltimore, Md., was damaged by fire, and new equipment will be needed.

For the establishment of a large ice-cream manufactory, L. M. Handler has purchased the former power house of the old Baltimore City Passenger Railway Co., Baltimore and East Sts., Baltimore, Md. Mr. Handler has organized the Handler Creamery Co. and will commence at once the equipping of the building with all the latest ice-cream manufacturing machinery.

The Ellicott Machine Co., Bush and Severn Sts., Baltimore, Md., has purchased a large tract of land and will erect a new plant for the manufacture of dredges.

The Nilson Yacht Building Co., Baltimore, Md., is erecting a new plant for the manufacture of boats. L. J. Nilson is manager.

SOUTHERN STATES

The Carr Knitting Mills, Suffolk, Va., manufacturer of hosiery, has increased its capital stock $8000, and will purchase new machinery.

The Armour Packing Co., Chicago, Ill., will establish a new plant, to cost $50,000, at Bluefield, W. Va.

F. J. Hansen, of Fitzgerald, Ga., contemplates establishing a $75,000 plant in Columbus for the manufacture of art brick, and has made a proposition to that effect to the local board of trade.

The Piedmont Portland Cement Co., Portland, Ga., has voted $250,000 bonds for the purpose of tripling the capacity.

The Florida Consolidated Canning Co. has awarded a contract to John A. Newstead, Jacksonville, Fla., for the construction of a new plant. The structure will be two stories high, 192x66 ft., and will be located at the foot of Dora St.

The plant of the Grenada Compress Co., at Houston, Miss., was destroyed by fire, Feb. 4.

The factory of the Houston Door & Sash Co., Houston, Miss., was completely destroyed by fire, Feb. 4. Loss, $20,000, partly covered by insurance.

The cotton gin at Mayna Vista, Miss., owned by H. L. Mayer, was burned, Feb. 3. Loss, $2000.

The grain elevator, coal yard and stables of Cogar & Co., at Midway, Ky., were destroyed by fire, Feb. 5. Loss, $30,000. Insurance, $20,000.

A ginnery, at Gainesville, Fla., owned by Mrs. Lois Tucker, was burned, Feb. 7, at a loss of $15,000, with partial insurance.

The mill of the White-Walter Lumber Co., Autaugaville, Ala., was partially destroyed by fire recently. The estimated loss is $9600.

MIDDLE WEST

A new machine room will be added to the paper mill of the Sterling Paper

Co., Hamilton, Ohio, for the construction of which contracts will be let shortly. A new 136-in. machine for ledger paper is specified among other equipment.

The Hamilton Autograph Register Co., Hamilton, Ohio, will add to its shop equipment.

The capital stock of the Canton Broom & Brush Co., Canton, Ohio, has been increased from $30,000 to $100,000 for the purpose of erecting a new plant in the spring. The company plans to double the output.

The Otthon Printing & Publishing Co., Cleveland, Ohio, will buy printing and binding machinery. D. W. Turk is manager.

The Central Ave. Lumber & Supply Co., Columbus, Ohio, will buy some wood-working machinery.

The Gansberg-Shirk Lumber Co., Indianapolis, Ind., will erect an addition to its plant.

The Detroit Creamery, Detroit, Mich., will erect a $15,000 addition to its plant.

The plant of the South Side Lumber Co., at Traverse City, Mich., was burned on Feb. 10, the loss being estimated at $100,000.

Fire in the four-story building at 251 Jefferson Ave., Detroit, Mich., occupied by the Goodyear Tire & Rubber Co., caused a loss estimated at $200,000, on Feb. 12.

The American Malted Milk Co., Waukesha, Wis., will erect a new plant. Henry C. Hughes, 702 Grand Ave., Milwaukee, is the architect.

The Little Wolf Mills, Manawa, Wis., were recently destroyed by fire. P. K. Smith is the owner.

The Lake Superior Iron & Chemical Co., of Ashland, Wis., will erect a large sawmill.

WEST OF THE MISSISSIPPI

The elevator of the Canistota Grain Co., at Canistota, Iowa, was destroyed by fire, Feb. 5. Loss, $26,000, partly covered by insurance.

The Peerless Separator Co., Waterloo, Iowa, is considering plans for the erection of additions to its plant.

The Acme Brick & Tile Co. will erect a new plant at Webster City, Iowa.

The Cedar Falls & Union Mill Co., Cedar Falls, Iowa, will soon begin the erection of a new mill.

J. R. Young, Downing, Wis., and Geo. Besecker, Oskaloosa, Iowa, contemplates erecting a canning factory at Brighton, Iowa.

F. G. Hartwell, president of the Berwind Coal Co., Duluth, Minn., has announced that his firm will erect a coal-unloading plant at West Duluth, to cost $2,000,000.

The Shelby Coöperative Creamery Association will erect a modern creamery at Moorehead, Minn.

The Hennigson Produce Co., Butte, Mont., will erect a modern creamery at Corvallis, Mont.

The plant of the Helena Packing & Provision Co., Helena, Mont., was destroyed by fire, Feb. 5. Loss, $20,000, covered by insurance.

The plant of J. C. Bulis & Co., manufacturer of corrugated paper novelties, 313 North Main St., St. Louis, Mo., was destroyed by fire, Feb. 9. The loss was $20,000.

The Timpson Handle factory, Timpson, Tex., which was recently destroyed by fire, is to be rebuilt.

M. C. Gregory will install an eight-stand cotton gin, at Harlingen, Tex.

The Kahn-Schafer Ice Cream Co. has purchased a site in Galveston, Tex., and will erect new factory buildings. The estimated cost of the improvements is $20,000.

The Union Slaughtering Co., Galveston, Tex., is planning the erection of a meat-packing plant and abattoir here, at a cost of $50,000.

The Whiffle-Tree Attachment Co., Lindale, Tex., is preparing to erect a manufacturing plant to make a patented whiffle-tree attachment.

Louis Florman is awarding contracts for the construction of a five-story paint factory in Pueblo, Colo.

The entire plant of the Great Western Oil Co., Denver, Colo., was destroyed by fire, Feb. 10, with a total loss of $75,000. Insurance, $42,000.

The Green Shingle Co., Sedro-Woolley, Wash., whose plant, at Cokedale Junction, was recently destroyed by fire, will rebuild.

The Seattle Cracker & Candy Co., Seattle, Wash., will soon commence the construction of a new plant. Estimated cost, $100,000.

The Metropolitan Building Co., Seattle, Wash., are preparing plans for a new laundry plant to be erected by R. F. Dent, at Seattle.

WESTERN STATES

The Inspiration Consolidated Copper Co., Globe, Ariz., expects to build a large concentrator in a short time.

The St. Paul & Tacoma Lumber Co., Tacoma, Wash., will erect a new planing mill, with a capacity of 150,000 ft.

The Milton Fruit Growers' Union and the Walla Walla Fruit & Vegetable Union, Walla Walla, Wash., contemplate the construction of a joint fruit-canning plant here.

The Puyallup & Sumner Fruit Growers' Association, Puyallup, Wash., will make extensive improvements and additions in its fruit-canning plant.

J. A. Shotwell, Seattle, Wash., plans the construction of an electric fruit evaporator and ice-manufacturing plant at Monitor, Wash. Estimated cost, $40,000.

The Clay Products Co., Spokane, Wash., will soon commence the construction of a new plant for the manufacture of stoneware. The plant will cost $50,000, and will be fully equipped.

Mark Ewald and associates, Olympia, Wash., will soon commence the erection of a fruit-canning plant here. Modern machinery will be installed.

The National Ice & Cold Storage Co., San Francisco, Calif., will build a cold-storage plant at Watsonville, Calif.

The Banner Creamery Co., Lynden, Wash., will increase the capacity of its creamery plant. A cold-storage plant will be erected in the near future.

The Wendling-Johnson Timber Co., Eugene, Ore., announces that it will construct a mill on the lower Suislaw River, at a cost of nearly $1,000,000.

The Frank Spulak Co., New Era, Ore., plans the erection of a new brick and tile plant here.

A permit to erect a two-story brick warehouse to cost $35,000, has been granted the Alta Planing Mill Co. The building will be 120x120 ft., and located at 1763 and 1765 East Ninth St., Los Angeles, Calif.

George A. Wright, Lindsay, Calif., will soon commence the erection of a lumbering plant. Modern machinery will be installed.

Leslie & Woody, Oroville, Calif., have acquired the Ophir Lumbering plant, and will make extensive improvements and additions.

The Burr Packing House Co., Orangehurst, near Exeter, Calif., contemplates increasing the capacity of its plant.

Armour & Co., Chicago, Ill., plan the erection of a cold-storage plant on Seventh and K Sts., San Diego, Calif.

The Standard Felt Co., Alhambra, Calif., has taken out a permit to build a new manufacturing plant. Modern machinery will be installed.

The Pacific Packing Co., San Fernando, Calif., plans to increase the capacity of its plant.

The Central Creamery Co. plans the erection of a new creamery plant at Crescent City, Calif. The plant will be fully equipped.

The Esperanza Consolidated Oil Co., San Francisco, Calif., contemplate the erection of an oil-refining plant at Los Angeles, Calif. John Barneson is interested.

The Pacific Marine Products Co., San Pedro, Calif., has acquired a site on Mormon Island, and plans to erect a fish curing and canning plant.

CANADA

Fire completely destroyed the Woodside plant of the Acadia Sugar Refining Co., Halifax, N. S., causing a loss of $1,000,000.

The Consolidated Pulp & Paper Co. announces it will build a big paper and pulp plant at St. John, N. B. The estimated cost is $2,000,000.

The sash and door factory of the D. McCormick Co., St. Boniface, Man., was totally destroyed by fire, Feb. 11, with a loss of $25,000 in buildings and machinery.

For proposed improvements and additions to be made at Calgary, Alta., by the Canadian Pacific Ry. Co., see item under Metal Working, Canada.

NEW INCORPORATIONS

METAL WORKING

The National Metal Seal Co., Portland, Maine, has been incorporated, with a capital of $1,000,000, to manufacture bottles and cans. H. W. Pattee, president, Boston, Mass., and H. T. Hall, treasurer, Portland, Maine.

The Decker Brothers Lock, Nut & Bolt Co., Saco, Maine, has been incorporated, with a capital of $150,000, to manufacture locks, nuts and bolts. M. L. Decker, president, Maxwell, Neb.; E. E. Bean, treasurer, Old Orchard, Maine.

The Hatfield Auto Truck Co., Elmira, N. Y., has been incorporated with a capital of $1,500,000 to manufacture automobiles. The incorporators are D. H. McConnell, A. D. Henderson and G. H. Brown, New York City.

The Koerting & Mathiesen Co., New York, N. Y., has been incorporated, with

a capital of $25,000, to manufacture electrical supplies. The incorporators are H. R. Boker, H. Ryan and J. L. Suydam, New York.

The Amerital Manufacturing Co., New York, N. Y., has been incorporated, to manufacture automobile accessories. The incorporators are W. O. Turrell, 720 West One Hundred and Eighty-first St., and L. Schwarz, 100 Morningside Ave., New York.

The Wonham, Sanger & Bates Co., New York, N. Y., has been incorporated, with a capital of $55,000, to manufacture railroad supplies. The incorporators are F. S. Wonham, J. R. Bates, 30 Church St., and W. Roberts, 35 Wall St., New York City.

The Requa-European Motor Co., New York, N. Y., has been incorporated, with a capital of $10,000, to manufacture motor engines and vehicles. The incorporators are L. F. Requa, 267 West Seventy-ninth St.; F. Charavey, 517 West Twenty-first St., and E. S. Beach, 149 Broadway, New York City.

The General Steel Manufacturing Co., New York, N. Y., has been incorporated, with a capital of $25,000, to manufacture and deal in metal. The incorporators are J. McLaren, E. C. Inderlied and F. B. Knowlton, 154 Nassau St., New York City.

The Electrene Co., New York, N. Y., has been incorporated, with a capital of $20,000, to manufacture hardware and machinery. The incorporators are W. L. Harrison, Branford, Conn.; E. N. Whitfield, 340 West Fifty-seventh St., and R. L. Tabor, 326 West Eighty-third St., New York City.

The Auto Show Co., Paterson, N. J., has been incorporated, with a capital of $50,000, to do a general automobile business. The incorporators are W. McKee, T. Beggs, and G. F. Wright, Paterson.

The Hudson Cornice & Skylight Co., Bayonne, N. J., has been incorporated, with a capital of $57,000, to manufacture skylights. The incorporators are O. Meyers, 81 West Twenty-third St; M. Bayroff and J. Bayroff, 399 Ave. C, Bayonne.

The Hudson Automobile Exchange, West New York, N. J., has been incorporated, with a capital of $100,000, to do a general automobile business. The incorporators are A. Aragona, 505 Morgan St.; A. Shulman, 270 Bergenline Ave., and W. F. Burke, 4606 Hudson Blvd., Union, N. J.

The New Columbia Garage, West End, N. J., has been incorporated, with a capital of $10,000, to operate an automobile garage. The incorporators are A. J. Heeney, S. C. Fiero and G. Feinberg, all of Brighton Ave., West End, N. J.

The Sheet & Tin Plate Manufacturing Co., Pittsburg, Penn., has been incorporated, with a capital of $100,000,000, to manufacture sheet and tinplate ware. The incorporators are G. W. Niedringhaus, W. A. Thomas, J. Andrews and R. D. Campbell. This is a holding company.

The Eagan-Rogers Steel & Iron Co., 929 Chestnut St., Philadelphia, Penn., has been incorporated, with a capital of $100,000, to manufacture steel and iron castings. The incorporators are J. I. Rogers and D. C. Eagan.

The Everett Auto Co., Baltimore, Md., has incorporated, with a capital of $60,000, to conduct a garage. The incorporators are Clyde E. Hunter, Bernard H. McGinn and Francis E. Magee, Baltimore.

The Birmingham Metal Product Co., Birmingham, Ala., has been incorporated, with a capital of $35,000, to manufacture corrugated tanks. The incorporators are J. H. Dean, S. Jacob and H. O. Barnard.

The Southern Foundry & Machine Co., Lexington, Tenn., has been incorporated, with a capital of $10,000, to manufacture machinery. The incorporators are A. E. Beasley, C. G. Gathings, T. A. Lancaster and J. S. Fielder.

The M. B. Bertram Engine Co., Cleveland, Ohio, has been incorporated, with a capital of $30,000, to manufacture gas engines. The incorporators are M. B. Bertram, A. A. Guthrie, K. C. Smith, L. W. Kelley and A. C. Wallace.

The Smart Manufacturing Co., Indianapolis, Ind., has been incorporated, with a capital of $10,000, to manufacture automobile accessories. The incorporators are B. Smart, L. B. Willis, J. N. Shelton and G. Williams.

The Oakes Manufacturing Co., Indianapolis, Ind., has been incorporated, with a capital of $10,000, to manufacture auto parts. The incorporators are W. D. Oakes, W. H. Oakes and C. P. Oakes.

The General Industrial Manufacturing Co., Indianapolis, Ind., has been incorporated, to manufacture auto trucks of 1000-lb. capacity. The incorporators are C. H. Wallerich, general manager, and T. B. Saycock, president, Indianapolis.

The Dart Manufacturing Co., Waterloo, Iowa, has been incorporated, with a capital of $600,000, to manufacture automobiles and trucks. The incorporators are C. W. Hellen, W. Galloway and M. L. Bowman, Waterloo.

The St. Louis Motor Truck Co., St. Louis, Mo., has been incorporated, with a capital of $7500, to manufacture and deal in automobiles. The incorporators are C. H. Joerding, E. L. Haydock, H. L. Boldeker and J. P. Camp.

The Guthrie-Mitchell Co., Little Rock, Ark., has been incorporated, with a capital of $200,000, to manufacture electrical supplies and machinery. The incorporators are W. M. Mitchell, J. A. Guthrie and H. C. Locklar.

The Germania Refrigeration & Machine Co., San Antonio, Tex., has been incorporated, with a capital of $75,000, to manufacture refrigerators and machinery. Y. Hicks is president.

The Cline Protective Signal Co., Arizona, has been incorporated, with a capital of $500,000, to manufacture burglar alarms. O. P. Haymaker is president.

The Mechanical Manufacturing Co., Seattle, Wash., has been incorporated, with a capital of $10,000, to manufacture tools. The officers are E. M. Smither, president; R. Rundstrom, vice-president; C. R. Donovan, treasurer; W. E. Mason, secretary, and H. R. Mitchell, manager.

GENERAL MANUFACTURING

The Miller Co., Providence, R. I., has been incorporated with a capital of $200,000, and will erect a plant for the manufacturing of articles made from wood and iron. The incorporators are J. B. Nash, W. E. Miller and W. A. Watts.

The Bristol Jewelry Co., Providence, R. I., has been incorporated with a capital of $100,000 to manufacture plated silverware and jewelry. The incorporators are H. O. Bigney and J. E. Pender, of Providence, and P. R. Cook, of Attleboro, Mass.

The B. & B. Manufacturing Co., Providence, R. I., has been incorporated with a capital of $50,000 to do a general manufacturing jewelry business. The incorporators are E. W. Beck, V. W. Beck and A. I. Cushing, all of Providence.

The New Britain Planing & Moulding Works, New Britain, Conn., has been incorporated with a capital of $10,000 to conduct a wood-working plant. The incorporators are Alva P. Leavitt, George H. Bush and Clarence S. Rush.

The Marmifora Co., New York, N. Y., has been incorporated with a capital of $100,000 to manufacture articles from marble and stone. The incorporators are A. C. Saportas, H. C. Harnickell, New York, and G. Bell, New Brighton.

The William Hughes & Co., Brooklyn, N. Y., has been incorporated with a capital of $150,000 to manufacture paper and paper supplies. The incorporators are W. Hughes, P. McNiel and J. McNiel, Brooklyn.

The Watervliet Wood Working Co., Watervliet, N. Y., has been incorporated with a capital of $75,000 to manufacture moldings and wood work. The incorporators are A. Brownell, M. L. Blanchard and E. S. Hazeltine, Albany, N. Y.

The National Corrugated Box Co., New York, N. Y., has been incorporated with a capital of $50,000 to manufacture boxes. The incorporators are L. L. Harr, J. B. Harr, 170 Broadway, and A. F. Cooley, 52 Broadway, New York.

The Schulman & Co., Brooklyn, N. Y., has been incorporated with a capital of $200,000 to manufacture confectionery. The incorporators are L. Schulman, A. Schulman and D. Schulman, 84 Leonard St., New York City.

The Mechanicsville Brick Co., Stillwater, N. Y., has been incorporated to manufacture and deal in bricks. The incorporators are M. L. Welling, R. A. Moore and J. M. Purcell, Mechanicsville, N. Y.

The Manning Sand Paper Co., Troy, N. Y., has been incorporated with a capital of $300,000 to manufacture sand paper. The incorporators are J. A. Manning, Troy; L. S. Greenleaf, Loudonville, and J. H. McCormick, Albany.

The Non Oxidizing Oil Co., New York, has been incorporated with a capital of $30,000 to manufacture oil. The incorporators are T. E. Stearns, 4301 Park Ave.; G. D. Snyder, 52 Bradford St., and C. E. Damon, 4301 Park Ave., New York City.

The Columbia Non-Refillable Bottle Co., New York, has been incorporated with a capital of $125,000 to manufacture bottles. The incorporators are G. Glocker, 717 Tenth St., N. W., Washington, D. C., and M. C. Bradley, 128 Sixth Ave., New York City.

The Washington Magazine Penholder Co., New York, N. Y., has been incorporated with a capital of $25,000 to manufacture pens, holder and fountain pens. The incorporators are W. W. Washington, W. H. Marrow, New York, and J. J. Quinn, Brooklyn.

Frederick Schill & Co., Irvington, N. J., has been incorporated with a capital of $100,000 to manufacture doors, blinds and moldings. The incorporators are F. Schill, H. Schill and E. Schill, Newark, N. J.

The Atlanta Spring Bed Co., Newark, N. J., has been incorporated with a capital of $100,000 to manufacture bedsteads, beds and couches. The incorpor-

ators are C. Beck, I. Beck, L. Sender and Gillinson, Newark.

The Sun Rubber Co., Bloomfield, N. J., has been incorporated with a capital of $10,000 to manufacture rubber goods. The incorporators are C. L. Muller, 447 Broad St., Newark; P. E. Bachrach, Bloomfield; J. Horwitz, 293 Hunterdon St., Newark, N. J.

The Three Ply Cup Co., Camden, N. J., has been incorporated with a capital of $125,000 to manufacture paper cups and bottles. The incorporators are W. S. Darnell, M. VanBooskirk, 423 Market St., Camden.

The Railroad, Steamboat Sanitary Supply Co., Plainfield, N. J., has been incorporated with a capital of $200,000 to manufacture sanitary articles. The incorporators are W. R. Townsend, E. R. Dodge and F. Carter, all of 220 Park Ave., Plainfield, N. J.

The Saddle River Worsted Mills Co., Newark, N. J., has been incorporated, with a capital of $250,000, to manufacture wool and woolen goods. The incorporators are R. L. Lindell, Passaic; T. B. Jevons and H. B. Major, New York.

The Blue Ridge Manufacturing Co., Elkin, W. Va., has been incorporated, with a capital of $25,000, to manufacture lumber. R. H. Chatham, Elkin, is interested.

The Raeford Furniture Co., Raeford, N. C., has been incorporated, with a capital of $25,000. The incorporators are W. E. Freeman, J. A. McDearmid and C. R. Freeman.

The Pee Dee Brick & Tile Co., Pee Dee, N. C., has been incorporated, with a capital of $25,000. The incorporators are T. R. Barringer and C. P. Terry.

The Wood Pulp Manufacturing Co., Waycross, Ga., has been incorporated, with a capital of $1,000,000, to manufacture paper. A. K. Sessoms is president.

The Morton Butler Timber Co., Chicago, Ill., has been incorporated, with a capital of $500,000, to erect and operate sawmills in Tennessee. The incorporators are M. Butler, 140 South Dearborn St.; W. C. Boyden, L. Bell and W. D. Bangs, 35 Dearborn St., Chicago.

Forthcoming Meetings

American Society of Engineer Draftsmen. Regular Meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Hotel Bellevue. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month, Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

American Boiler Manufacturers' Association, in conjunction with Supplymen's Association. Twenty-fourth annual convention, New Orleans, La., Mar. 12-15. J. D. Farasey, secretary, East Thirty-seventh St. and Erie R.R., Cleveland, Ohio.

American Society for Testing Materials. Annual meeting, New York City, Mar. 28-29. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Master Boiler Makers' Association. Sixth annual convention, Fort Pitt Hotel, Pittsburg, Penn., May 14-17. J. Rogers Flannery, secretary arrangements committee, Flannery Bolt Co., Pittsburg, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

California

A THOROUGHLY competent, middle-aged man, experienced in handling from 100 to 200 men, for a shop close to Los Angeles, Calif., and manufacturing riveted steel pipe, and doing a general light and heavy plate and tank business; must be thoroughly conversant with modern shop methods, a master of handling men and obtaining a maximum of production at a minimum of cost; a steady position with advancement for the right man; state age, experience, references and salary expected. Address "Manufacturer," Box 965, Am. Machinist.

Connecticut

HARDENER—A thoroughly practical hardener, one experienced in heat treating, hardening and tempering carbon and alloy steels, and capable of taking full charge of such work; only a man of good habits will be considered, and he must be one who is still able to learn. Address with full particulars as to experience, salary expected, etc., to "Steel Hardener," Am. Machinist.

MODEL MAKER—First-class on instrument work, such as taximeters, speedometers, carburetors, odometers, counters, etc.; a man with ability to carry out inventor's ideas. One with technical training preferred; must have phlegmatic disposition and not be easily discouraged; must be just as ambitious to succeed while working out another's ideas as his own, even though he considers his own better, and yet may feel free to make any suggestions that will in his mind be desirable. Box 929, Am. Machinist.

Maryland

SPOON MAKER—Must be experienced and familiar with uptodate methods of making retinned steel spoons, knives and forks; good opportunity for right man; give references. Address "Expert," Am. Machinist.

Massachusetts

INSPECTOR on gear jobbing work; state age, experience and wages expected. Boston Gear Works, Norfolk Downs, Mass.

TOOL MAKER—First-class workman required with experience in designing labor-saving tools. Address, stating age, experience and pay required, Box 983, Am. Machinist.

CHIEF DRAFTSMAN for concern manufacturing small electrical apparatus in large quantities; must be experienced in design of interchangeable quantity parts, familiar with uptodate shop methods, and must have worked at least one year in shop; full knowledge of English and German language required; in your reply state fully age, nationality, experience in detail, references and salary. Address "Draftsman," Box B, Springfield, Mass.

Michigan

A MAN acquainted with form tool work; one with some experience in gear-cutter work preferred. Box 982, Am. Machinist.

DRAFTSMAN—One who has had experience in mixing and agitating machines, also conveying and flour mill machinery; state experience and wages expected. Box 861, Am. Machinist.

Minnesota

DESIGNER and draftsman who is thoroughly familiar with the design and manufacture of folding film cameras; write in confidence, giving full particulars as to experience, age and salary expected. Box 831, Am. Machinist.

FOREMAN—A large corporation in Minnesota wishes to employ a foreman to take charge of pipe department; work consists of repair and upkeep of air and heating pipes in 800 cars, repair and upkeep of sewer pipes, plumbing and heating pipes in 20 large buildings and upkeep and supervision of seven heating plants; also installing this class of work in new cars and new buildings as they are erected; it will be necessary for foreman to take out a master plumber's license, and in addition to his knowledge of pipe work and plumbing it is necessary that he have considerable mechanical ability and be able to plan the details of the work after receiving the general plans; the position would be permanent, pays a good salary at the present time, and there are opportunities for advancement; in reply give age, nationality, and state exactly what positions you have held and for what length of time; applications will not be considered unless applicant makes clear in his answer just what experience he has had. Box 979, Am. Machinist.

Missouri

DESIGNER—Experienced jig and tool designer; one who has had experience on small rapid working jigs and tools; state age and references as to where you have produced results. Address Superintendent, Century Electric Co., St. Louis, Mo.

New Jersey

SUPERINTENDENT, to take charge of plant; preferably a man accustomed to the manufacture of wood-working machinery; employ about 200 men; state age, experience, etc. H. B. Smith Machine Co., Smithville, N. J.

TOOL MAKER, to take full charge of our milling and drilling department; must be a married man, capable of handling help and able to make all tools and fixtures; state age, experience and salary expected. Address Kraeuter & Co., 585 Eighteenth Ave., Newark, N. J.

WANTED—A first-class automobile garage shop foreman; must have good references and a thorough knowledge of the gas-engine business as applied to automobile construction; a permanent position at a good salary awaits the man who can fill requirements. Box 998, Am. Machinist.

New York

DESIGNER AND DRAFTSMAN on machine tools and special machinery; good opportunity for first-class man; state age, experiences, references and salary expected. Box 985, Am. Machinist.

FIRST-CLASS horizontal boring-machine and planer hands; permanent position and good opportunity for advancement, if competent; state experience and wages expected. Box 924, Am. Machinist.

DRAFTSMAN of experience in designing and making detailed drawings for high-grade, light-running machines; steady work for right man; when writing state experience and give references.

Ideal Wrapping Machine Co., Middletown, N. Y.

FOREMAN—Must be a hustler, good mechanic, sharp manager, and uptodate on piece work and latest shop practice; man having experience on such work as carburetors, mechanical lubricators, oil pumps, etc., preferred; give age, reference, experience, salary expected, and where now employed or no attention. Box 980, Am. Machinist.

SHOP SUPERINTENDENT wanted for machinery-manufacturing plant in the East, employing about 500 men; a thoroughly reliable and earnest man of experience is required who can produce good results at minimum cost; must be familiar with best shop practice and fully capable of handling men to advantage; the position requires a man of good executive ability; in answering state age, experience and salary expected. Box 986, Am. Machinist.

Ohio

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

TOOL MAKERS—Several first-class tool makers, experienced on small, accurate die work; state experience and salary wanted. Box 811, Am. Machinist.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Wisconsin

FOREMAN for machine shop employing about 50 men; must be up to date in modern methods of manufacturing small interchangeable parts, and a good executive; give previous experience, age and salary expected; state full particulars in first letter or no attention paid. "X Y Z," Am. Machinist.

POSITIONS WANTED

Connecticut

YANKEE, 45 years, 25 years' experience in machine and tool building; four years calculation and cutting spur gearing for textile and automatic machinery. Address Box 68, Tracy, Conn.

DESIGNING DRAFTSMAN, 15 years' experience various leading New England corporations, seeks position executive head drawing room; diplomatic; a producer. Address L. A. Esper, Box 977, Am. Machinist.

A YOUNG MAN, experienced in shop, office and drawing room, on tool design, interchangeable manufacture and general drafting wants responsible position with prosperous and growing concern; executive ability. Box 956, Am. Machinist.

FOREMAN—Tool-room foreman, or other responsible position; broad experience with leading corporations, on equipment, manufacturing and system, for varied lines of small and medium size product; ambitious and thorough mechanic. Box 969, Am. Machinist.

Illinois

SUPERINTENDENT—I desire a change; have had twenty years' factory experience, ten as superintendent; also inventor and designer. Box 996, Am. Ma.

MACHINE SUPERINTENDENT—Successful inventor and practical mechanic who can produce results in handling small interchangeable parts, desires a change. Box 984, Am. Machinist.

Indiana

DESIGNER, with broad experience on machine tools and manufacturing equipment. Box 995, Am. Machinist.

Michigan

TOOL DESIGNER—German college graduate, for five years with the first automobile concern in Germany as foreman and assistant superintendent, for two years with large American auto company as tool designer, thoroughly practical man, wants responsible position in shop or drafting room. Box 981, Am. Machinist.

New Hampshire

SUPERINTENDENT and manager desires greater opportunities; large experience in development of special machinery and patents; open for engagement after Apr. 1. Box 992, Am. Machinist.

New Jersey

MECHANICAL DRAFTSMAN—Graduate, two years' office experience. Box 993, Am. Machinist.

FOREMAN—Has had 10 years' experience handling men, uptodate shops; progressive; good organizer of shop force. Box 937, Am. Machinist.

DRAFTSMAN, experienced in checking machine shop, tool room, instrument and vacuum-cleaner work; also interchangeable tools. Box 973, Am. Mach.

CHIEF ENGINEER—Engineer with large brewery; age 34; building and power-plant construction, brewery and factory equipment, practical machinist and draftsman with technical education; position as chief engineer, superintendent or master mechanic. Box 978, Am. Machinist.

New York

MECHANICAL DRAFTSMAN, various experience, wishes position. Box 999, American Machinist.

DESIGNER, experienced in designing special and automatic machinery, wants position. Box 483, Am. Machinist.

DESIGNING DRAFTSMAN, wide experience special automatic machinery, desires change. Box 994, Am. Machinist.

TOOL MAKER—Mechanic, first-class all around accurate worker and mechanical draftsman, with executive ability. Box 988, Am. Machinist.

DESIGNING DRAFTSMAN, special and automatic machinery, development of ideas, wishes a situation. Box 997, Am. Machinist.

FACTORY ENGINEER—Skilled mechanic, expert in organization, tool design, cost reduction and increase of output, desires responsible position. Box 1, Am. Machinist.

Ohio

FOREMAN, die maker or superintendent; a thorough expert on all classes of work; good executive; the finest of references. Box 952, Am. Machinist.

Pennsylvania

DESIGNER, age 34, with shop experience, open for engagement; experienced on adding machines and special automatic machinery; prefer adding or similar machines. Box 971, Am. Machinist.

MANAGER—Mechanical engineer with 15 years' experience in sales and executive work wishes permanent position with manufacturing concern where enough of this experience is necessary to bring good returns. References to all previous employers. Box 990, Am. Machinist.

GENERAL FOREMAN or factory superintendent; 20 years' experience, eight years' as executive; specialty, steam and gas engines, sawmill, flour mill, mining and transmission machinery, light or heavy work; can furnish A1 references; open for engagement at once. Box 987, Am. Machinist.

Rhode Island

ENGINEER, young, graduate, foreigner, with about three years' mechanical shop and boiler shop practice, wants position. Box 928, Am. Machinist.

FACTORY ENGINEER—Chief draftsman under 35 years of age would change for better opportunities; uniformly successful on low cost production, designing tool work, medium-weight machinery, electrical, hydraulic elevators, machine tools, transmission and textile machinery; have energy, tact and resourcefulness; direct methods. Box 989, Am. Machinist.

Wisconsin

FOREMAN, machine shop, 15 years' experience, desires position immediately. Box 975, Am. Machinist.

GENERAL FOREMAN or factory superintendent, experienced on steam and gas engines, heavy and medium mill machinery and pneumatic tools; open for engagement at once; best of references. Box 974, Am. Machinist.

MISCELLANEOUS

For Sale—One 24x27 7-ft. iron planer. W. J. Ferrell Barberton, Ohio.

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Technical Patents. G. M. Sacerdote, M. E. and P. A., 1919 Broadway, New York.

Work wanted for hand screw machines; lowest estimates. Box 991, Am. Machinist.

Removal—On Mar. 1 will remove to larger quarters—No. 38 Vesey St., New York. Frevert Machinery Co.

High-grade machine work in quantities for gear cutters, hand turrets, milling machines, etc., wanted. The Seneca Falls Mfg. Co., Seneca Falls, N. Y

For Sale—Small machine shop in a first-class city in western Washington; grand opportunity for marine and gasoline work. Box 972, Am. Machinist.

Tool tempering chart, 13½x1½ inches, printed in colors with full description; 10 cents postpaid. Spon & Chamberlain, 123 Liberty St., New York, publishers.

10,000 sq.ft. new modern loft building; good light; accessible to all points; whole or part; term lease and reasonable rent to responsible tenants. McClellan & Co., Mount Vernon, N. Y.

Special machinery. We have the best facilities for building to order medium weight, high-grade machinery. Thirty minutes from Broadway. The Binsse Machine Co., Harrison, N. J.

For Sale — Bargain, machine shop, small metal work; complete nickel-plating plant and equipment for cabinet work; 12,000 sq.ft. in operation. Machine Co., 1131 South Broadway, St. Louis, Mo.

For Sale—One No. 14 Morgan nailing machine in first-class condition, with direct-connected 60-cycle, 220-volt motor; further particulars may be had on application to Cluett, Peabody & Co., engineering department, Troy, N. Y.

German, French and Great Britain manufacturing rights for sale on three valuable inventions, consisting of an attachment for utilizing furnace gases to heat feed water; speed-changing mechanism of new design, and an improved suction pump for heating, ventilating, refrigerating, etc.; fully protected by patents; complete information given upon request. Box 955, Am. Machinist.

Receiver's sale of machine shop, completely equipped for light manufacturing, models, or job work; known as F. G. Johnson Co.; located 172 Pearl St., Hartford, Conn.; established 12 years. Sealed bids for entire plant received until noon, Feb. 29, receiver reserving right to reject any bids. Unusual opportunity to buy old-established business at receiver's sale. For inspection or list of equipment address Fred H. Fuller, receiver, 172 Pearl St., Hartford, Conn.

February, 1912, Third Annual Magneto Bargain Sale; imported high tension magnetos at less than cost of importation; our third annual genuine inventory sale of U. & H. Master Magnetos, made in Germany, is now in progress; all hp. sizes and types for 1, 2, 4 and 6 cylinder motors, suitable for motor cars, motor wagons, motor boats, motorcycles, stationary engines, etc.; write now, before they are all gone, for circular and price list; the sale is a real Magneto money saver. J. S. Bretz Co., 250 West 54th St., New York.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

Talks With Our Readers

By The Sales Manager

Here's a clipping from the *Cleveland Press* which shows the opinion of the Cleveland City purchasing agent of the salesmen he meets.

This is it:

> "Leave Cigars Behind."
>
> That is the sign at the entrance to the office of A. R. Callow, city purchasing agent. It's right where it catches the eye of a salesman entering the office.
>
> "No, I haven't started an anti-smoking campaign," says Callow. "There are still a few salesmen who cling to the ancient practice of handing out cigars, and the sign is to head them off. I don't like the spirit in which a cigar is offered by a man with goods to sell.
>
> "The wise, modern salesman doesn't hand out cigars. He is a business man who believes in his goods and who assumes that the purchasing agent is intelligent enough to wish to learn something about the merits of a good article.
>
> *"And by the way, you can take the words of 90 out of 100 salesmen relative to the goods they handle. They know a lie is soon found out, and that it is fatal to their chances of future sales."*

The italics in that are ours and the emphasized portion points this lesson:

Probably no man is in a better position to judge the virtues or sins of a salesman than the purchasing agent of a large city. This one says that 90 per cent. of the salesmen tell the truth about their goods because, aside from any moral question, the lie would be fatal to their future chances.

Now, good advertising is nothing more nor less than printed salesmanship.

It, too, must be truthful or hurt its future chances beyond remedying.

The two-legged salesman might get away with the lie-stuff and hope that the memory of the purchasing agent would prove defective.

But the printed salesman is a recorded thing—it's down in black and white, preserved for all time, ready to be brought out against its perpetrator at any hour. The purchaser who has been buncoed has the printed evidence.

Do you imagine for a moment that any advertiser who is in business to stay will take a chance like that and pay real money for the white space in which to do it?

No, he'd be a short-sighted crook, to put it mildly.

This matter of truth-telling in salesmanship and advertising is a development of business science.

The modern business man wants to know what will pay him and what won't. When he knows, as he does today, that truthful statements are the ones that win out in the long run he hitches his wagon to that star and stands back of the printed word and the verbal one.

So you, who are interested in the Selling Section of the AMERICAN MACHINIST, can read, believe in and buy from the advertisements with a full measure of confidence.

* * *

Only reliable products can be continuously advertised.

Manufacturing an Adding Machine

By F. A. Stanley

Interesting methods in a large shop in southern Missouri, where a high-grade product is turned out with standard machines fitted up with special tools combining ingenuity of design with accuracy of construction.

Profiling and milling fixtures for finishing cases and side frames, and jigs for drilling and reaming numerous holes in the frames.

Milling fixture for holding carriage ball races for the finishing of outer and inner surfaces.

The Dalton Adding Machine Co., Poplar Bluff, Mo., has a splendidly equipped factory, and its manufacturing methods are of such interest that visitors cannot fail to feel well repaid for the trip of a few hours from St. Louis which is required to reach the town in which this plant is located.

This establishment in within 12 or 15 miles of the northern boundary of the State of Arkansas, and is, therefore, well to the southwest of the path usually followed by individuals who make it their business or pleasure to visit shops engaged in the production of machinery. For this reason the Dalton company's thoroughly modern system of manufacture, involving as it does, the utilization of a large number of special tools in addition to standard equipment, becomes of still greater interest than would be the case were the shop one of a score or more in a large manufacturing community.

General Equipment

In order to convey an adequate idea of the manufacturing departments, a few general views are presented in Figs. 1 to 5, which represent some of the larger and more important of the various groups of tools. Thus, in Figs. 1 and 2 of the milling department, a row of Pratt & Whitney profilers, and Brown & Sharpe and Cincinnati millers is seen. Fig. 3 shows a row of Brown & Sharpe automatic screw machines in the screw-machine department. A long line of Sigourney drillers is shown in Fig. 4, and a row of Ferracute presses in Fig. 5.

The stock rack for both the presses and the screw machines is illustrated in Fig. 6. This rack is directly across the room from the press department, and near the upper end of the screw-machine department, so that material is readily passed to either group of machines.

The stock rack is built into a concrete extension which is really a large vault at the rear of the main shop, and which serves also as a storage-room for press tools. The compartments for the flat stock and screw-machine rods run only about two-thirds the depth of the extension, and at the rear a narrow vault is formed which is lined with suitable shelves and compartments for punches and dies. The entrance to the press-tool vault is through the doorway shown at the left end of the view Fig. 6.

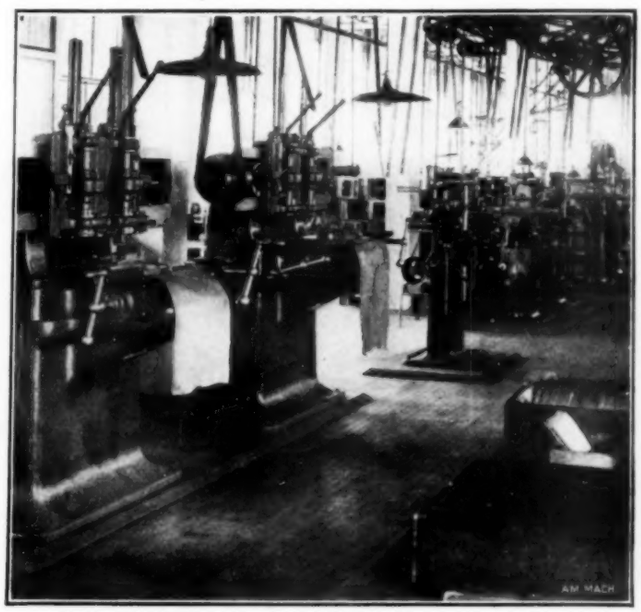
Details of different operations performed in the various departments, and illustrations of some of the special tools are included in the present article. Other features of interest will be described in a subsequent article.

Milling Top of Adding Machine Case

Most of the views in the following engravings represent methods of milling different parts, and the first of these, Fig. 7, shows a fixture on which the adding-machine case is held while the four pads for the carriage and ribbon-cup brackets near the top, are machined with a vertical milling attachment.

The lower edge of the case has already been milled and drilled for dowel pins and the holes are used for locating the case over pins in the milling fixture. There is a series of spring supports located directly under the spots to be milled and these are allowed to come into contact with the case as soon as the latter has been clamped to the fixture. The supports are clamped by screws which hold them fast during the passage of the cutter over the work.

The same fixture is used in another operation for holding the case for the milling of two bosses on one of its vertical faces. The method of locating and supporting the work is similar to that employed in the operation described above.



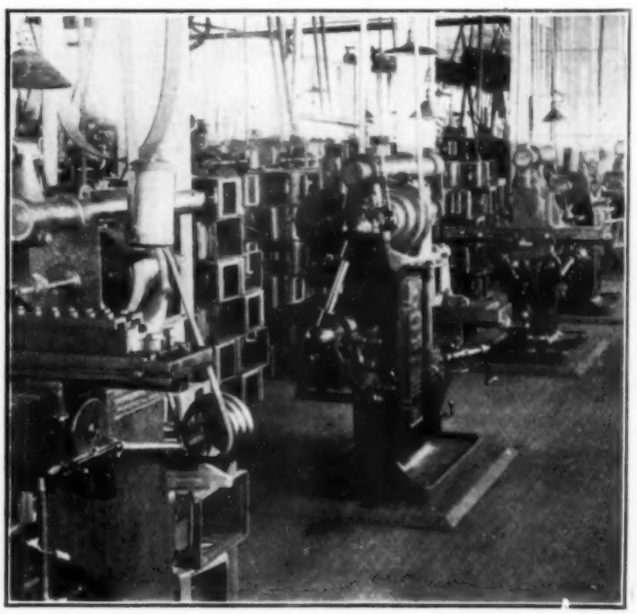


Fig. 1 The Milling Department Fig. 2

Operations on Side Frames

The method of profiling the bosses on side frames is shown in Fig. 8, which represents the first-operation fixture with a frame in place, and a faced one standing at the left side. The frame rests

for this operation on three fixed supports, and on a number of spring stops which are allowed to come into contact with the underside of the work after it has been seated on the fixed supports and clamped there by three eccentric binders with edges acting rather to draw it down in place.

The milling of the other side of the frames is accomplished by resting the work upon its finished bosses on a flat plate on the profiler, where it is again clamped by its edges, for the end milling of the flat surfaces.

FIG. 3. AUTOMATIC SCREW-MACHINE DEPARTMENT

FIG. 4. THE DRILLING DEPARTMENT

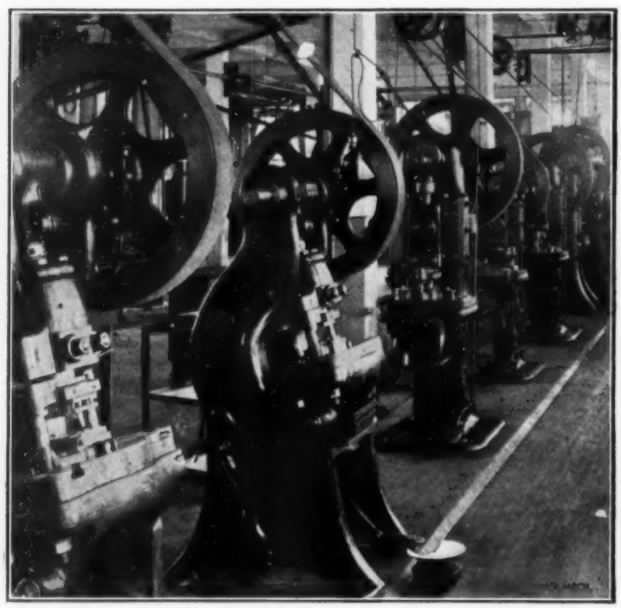


FIG. 5. A ROW OF PUNCH PRESSES

FIG. 6. STOCK RACK FOR STRIP AND BAR MATERIAL

knife edges which press the casting against three circular knife-edge end-stops. As the contact of these clamps and stops is along a sharp edge near the center of the thickness of the work, as shown in Fig. 9, there is no tendency for the casting to lift from its seat when it is being clamped, the bevel clamping

DRILLING SIDE FRAMES

The side frames are taken from the profilers to the drillers, Fig. 10, and here jigs are used for the different sizes of holes required through the frames. One of the jigs is shown on the table of the machine in the foreground, and it will be noticed that it provides for the drilling and reaming of a large number of holes.

There are three holes in the side frames that are later used for locating the castings on other fixtures and serve in fact as the locating points for all of the important operations. One of these holes is first drilled and reamed in the jig, Fig. 10, and a locating plug inserted through the jig and work. The second hole is then drilled and reamed and another plug slid into place. The third

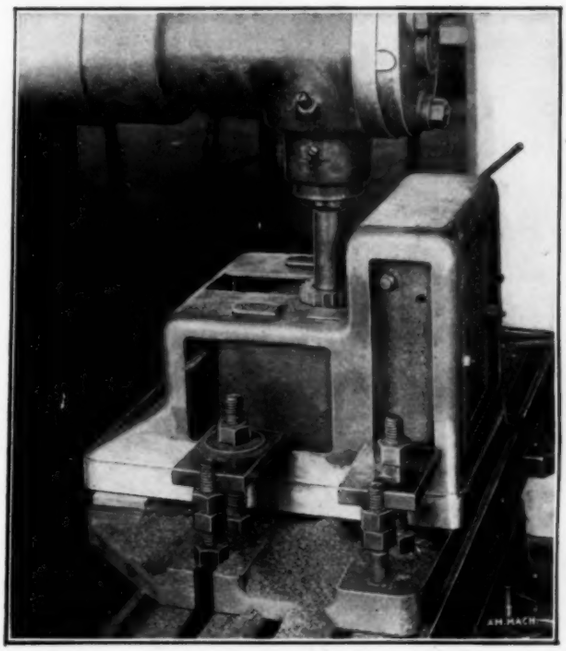


FIG. 7. MILLING ADDING-MACHINE CASE

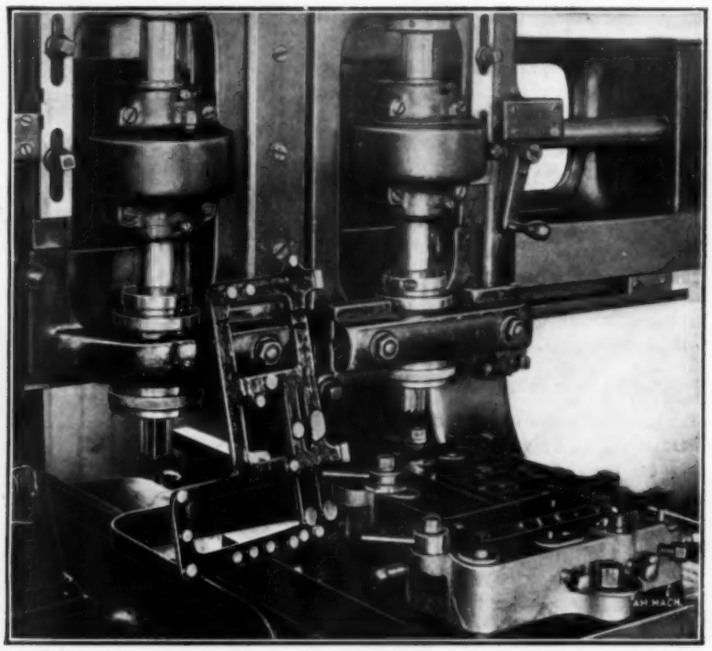


FIG. 8. PROFILING SIDE FRAMES

hole is put through and again a locating plug is inserted, these three plugs then being depended upon to retain the work in exact position in the jig during the remainder of the drilling operations.

DRILL AND REAMER GUIDES

An important feature of this work is the method of guiding the drills and reamers in the jigging process. The sketch, Fig. 11, shows the principle employed, and as indicated there, the drill and reamer are provided with long, hardened and ground steel sleeves which are secured to the body of the drill and reamer and which fit the guide bushings in the jig. The upper ends of the drill and reamer are held in the regular chucks and the long sleeves are secured by tightening the knurled nut at the top which closes the split end of the sleeve and causes it to grip the drill or the reamer and run perfectly concentric with it.

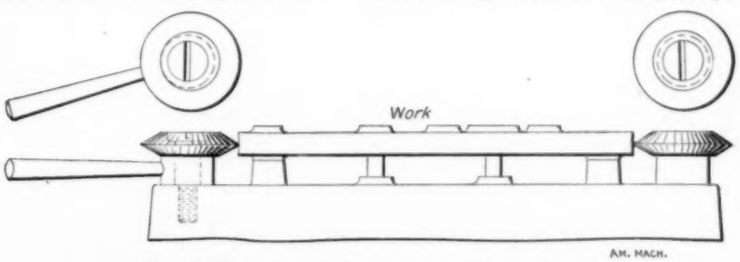


FIG. 9. KNIFE-EDGE BINDERS FOR SIDE FRAME

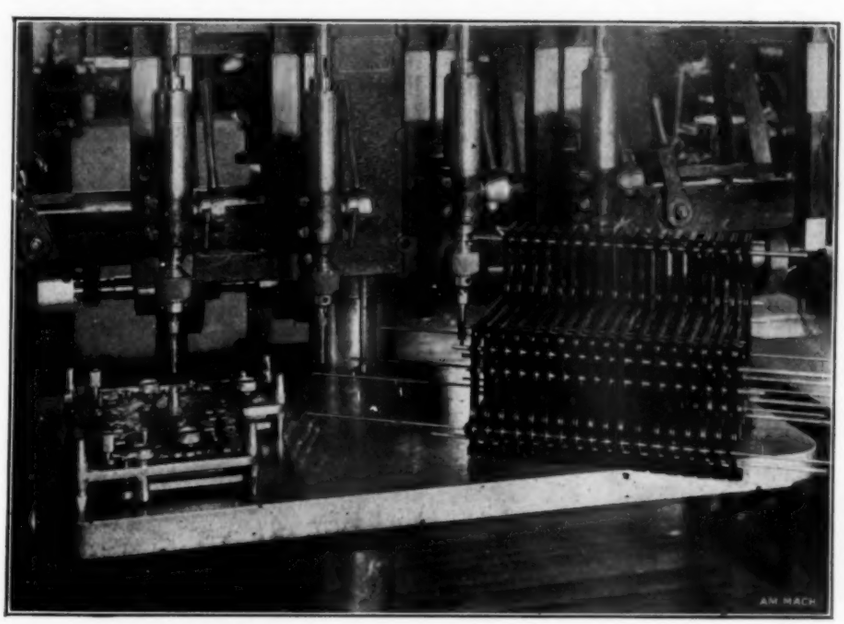


FIG. 10. DRILL JIG FOR SIDE FRAMES

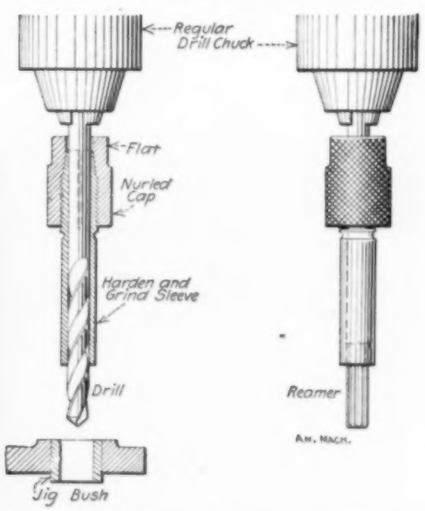


FIG. 11. TOOLS FOR DRILLING AND REAMING WORK IN JIGS

The outside diameters of the sleeves are ground to some standard size to run properly in the jig bushings. This method makes it unnecessary to change jig bushings for reaming after drilling, and also provides an easier way of guiding the

tools than is possible where the drill and reamer have to be permanently fixed in an enlarged body or shank, as they can be removed instantly for inspection or grinding, can be readjusted for length at any time and may be immediately replaced by new tools when broken.

An indication of the accuracy obtained with the drill-jigs on this work is given by Fig. 10, where, at the right end of the table, 18 side frames selected at random from a batch of work, are shown side by side with some 16 drill-rods of the exact sizes of the respective holes, pushed through from end to end.

Milling and Testing Frame-Edges

Two operations on side frames are represented in Fig. 12. The milling fixture on the table holds the frame for the end milling of the feet on the lower edge of the casting. The frame is located by the three holes which were drilled and reamed at the outset in the jig in Fig. 10, and it is secured by three simple clamps as shown. After it has been fed past the end mill it is placed on a test gage (which is shown on the end of the table) to determine if the feet are correctly finished in relation to the three holes used as locating points in previous operations.

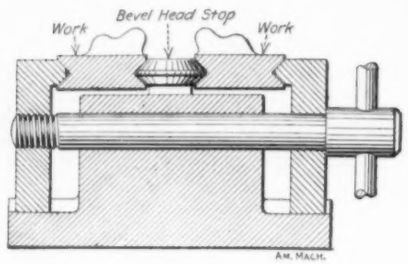


Fig. 15. Sectional View of Fixture for Straddle Milling Lugs on Carriage of Inner Race

The frame is placed over plugs which fit the three holes and in order that these holes shall align exactly when the machine is assembled, the feet of the frames must all indicate alike when tested on the gaging device. This carries four indicator pointers as shown, in order that the same gage may be used for the three feet on both right- and left-hand frames, and if the work is correctly milled the three pointers must stand at zero, when the contact ends are against the feet being tested.

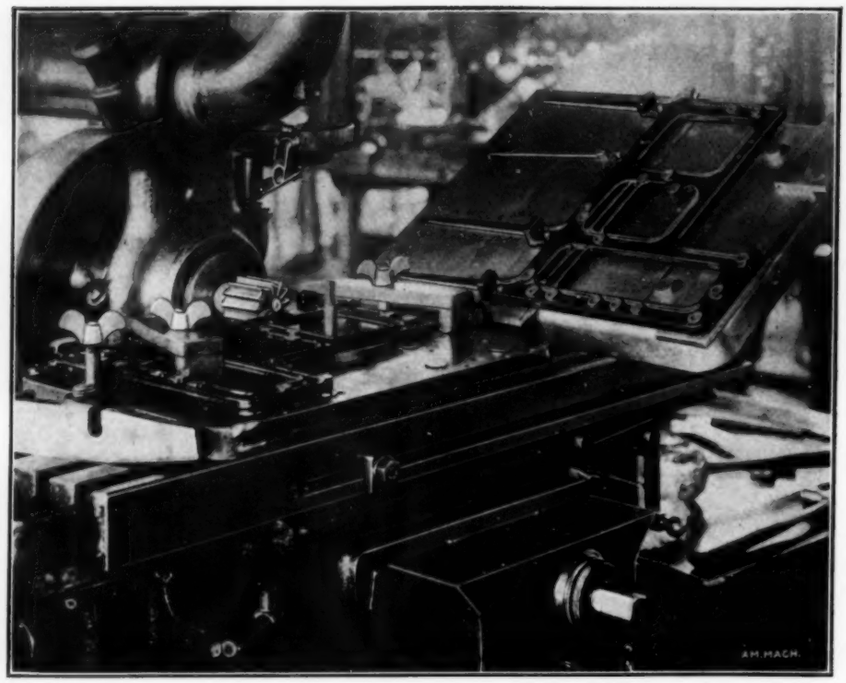
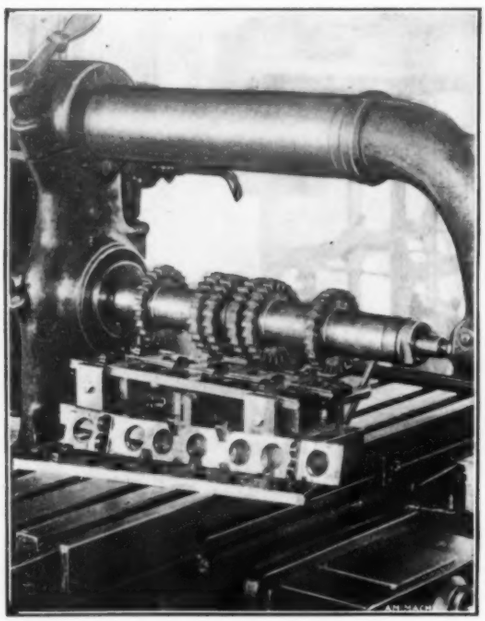


Fig. 12. Milling and Testing Side-frame Feet

Machining Carriage Ball-Races

Two operations on carriage inner races are illustrated by Figs. 13 and 14. The first is the straddle-milling of the lugs on the face of the casting; the other the finish milling of the V-shaped race proper along the edge. These V's are first roughed out in the fixture shown in Fig. 14, two at a time, with a pair of cutters. The work then is placed in the fixture in Fig. 13 where the outer two lugs are finished on the outside and the inner pair straddle-milled, with the six cutters on the arbor.



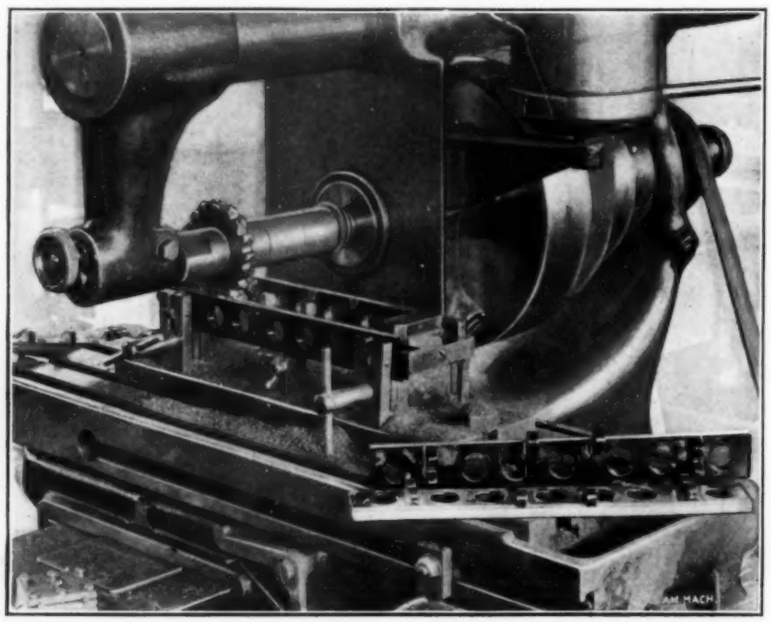


Fig. 13 Milling Inner Ball Races for Carriages Fig. 14

Two castings are held at once on this straddle-milling fixture. At each end, in the center of the fixture, there is a locating stop in the form of a disk with V-shaped edge, and against these two disks the inner V's of the two races are pressed by the outer jaws which are also formed with V-shaped upper ends. When the two operating screws are tightened, the two pairs of jaws hold the work tight against the central stops with their V-heads, and the work is thus secured once by their V's without preliminary setting by the operator, and without requiring him to hold the work in place while setting up the clamping jaws.

Finishing the Races

When the inner races are returned to the fixture in Fig. 14 for the finishing of the V's, a single cutter is operated, as it was found upon trial that two cutters could not be kept sufficiently uniform in diameter to warrant the taking of

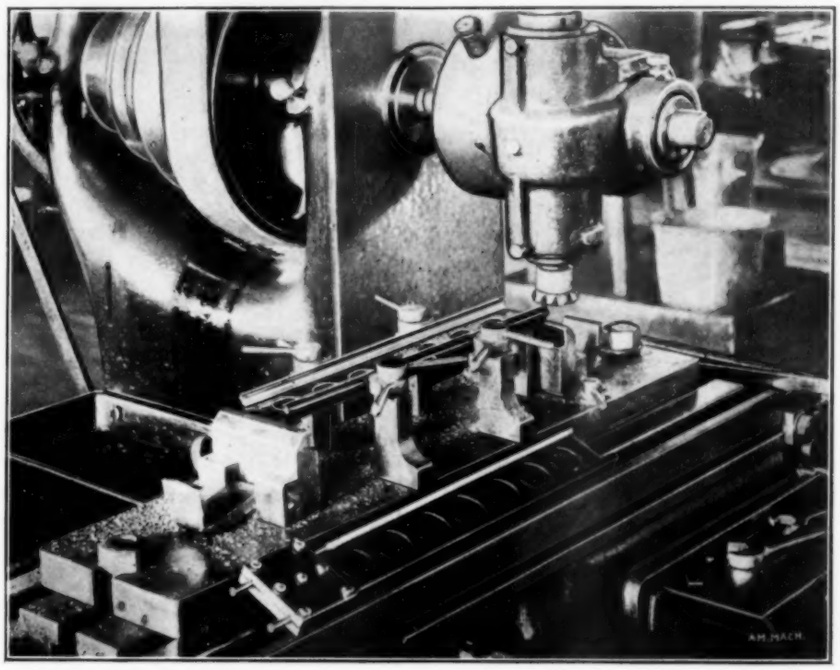


Fig. 17. Milling Outer Races for Carriages

true with its ball channels and the lugs must necessarily be square with the races when milled in this manner. The sectional sketch, Fig. 15, gives a good idea of this method of locating and clamping the two castings by their races.

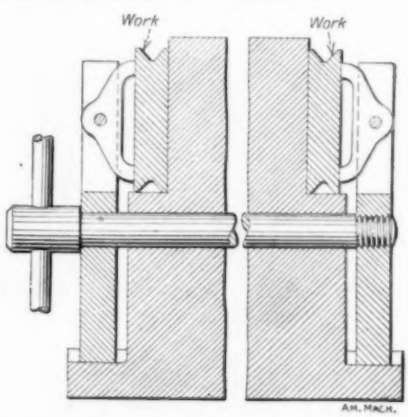


Fig. 16. Section of Fixture for Milling Inner Races

Another interesting feature of this fixture is an elevating device at the middle which lifts both castings to the right height to permit them to be clamped at finishing cuts in two races simultaneously, although the same fixture is used as in the roughing process. As indicated in the halftone and in the sketch, Fig. 16, the two races are drawn up against opposite sides of a fixed inner jaw at one end of the fixture, by the long clamp-screw, and by the outer jaws which carry equalizing contact-shoes at their upper ends in order to grip the work evenly at top and bottom. At the same time an adjustable jaw between the other ends of the two races comes into proper contact with both castings, and the outer clamps at that end, with their equalizing jaws, are set up tight. Thus each of the races is seated against what amounts to a three-point bearing, and is held to that seat by floating jaws that conform to the surface of the work without liability of springing it.

A type of gage used for holding the milling of the races to close limits, is shown resting on the knee of the miller in Fig. 14. The gage is made up of a pair of steel plates with V-grooves in their inner faces in which steel plugs are clamped of the same diameter as the balls for the races. The plugs project at each end a half inch or so, and the pair of plugs at one end are 0.001 in. nearer together than those at the other side of the gage, this being the limit allowed in the finish-milling operation in the races.

Milling Outer Races

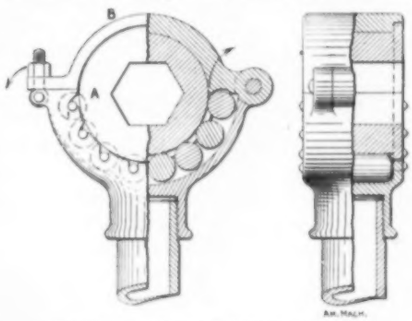
The fixture and cutter used in finish-milling the outer races are shown in Fig. 17. The ends are first straddle-milled in another operation, then the grooves along the inner edges of the race are roughed out with a cutter which forms a channel of square section so that the angular mill for finishing has comparatively little metal to remove. This finishing cutter is operated first along one side and then back on the other side after the table has been moved over to a stop to give the proper width between the cuts. The same limit gage is used here as in the testing of the inner races, and this gage will be seen in place in the race shown at the front of the fixture in Fig. 17.

The work is located centrally in the fixture by swinging gages at each end which are set upright to form stops for the position of the piece. The eccentric binders are then brought up against the work and the locating gages dropped back out of the way before the cut is started.

Roller Bearing Stock Guides

By Frank S. Bunker

The accompanying cut shows the construction of stock guides for use with turret and automatic machines, that eliminate a large part of the objectionable noise usually so much in evidence, keep the bars running true, make it easier to



Roller Bearing Stock Guide

feed up the stock, and lessen the power required to run the machines.

The block *A* through which the bar is run, may be made to fit any size or shape of stock and the various blocks may be easily removed or inserted in the head by raising the strap *B*, which is hinged and locked as shown.

The stock blocks are flanged to keep them from running out of the heads when in use. It will be noticed that rolls are placed in the lower half of the head only, where they are easily oiled and kept in place.

Making Repair Parts for Locomotives

Editorial Correspondence

Nearly all railroads make their own repair parts or buy them from the locomotive builders. There is a good little shop in Kansas, however, which is making a specialty of making locomotive cylinders, pistons and other parts and supplying them finished ready for the locomotive.

The illustrations show some of their methods and fixtures which enable them to turn these out accurately and economically.

So far as known there is no other shop in the country which makes a specialty of supplying parts of locomotives to the railroads, except the Finished Locomotive Materials Co., of Atchison, Kan. Although not a large plant, it has been built up on strictly manufacturing lines in contrast with the repair shops of most railroads and, without any pretense at elaboration, has an equipment which can turn out good work at a low cost.

The way in which it turns out cylinders, pistons and piston rings, cylinder heads and similar parts which are sufficiently standardized to be made in this way, would be a good object lesson to many other shops. We are indebted to the manager, Harry Muchnic, for the information and illustrations secured.

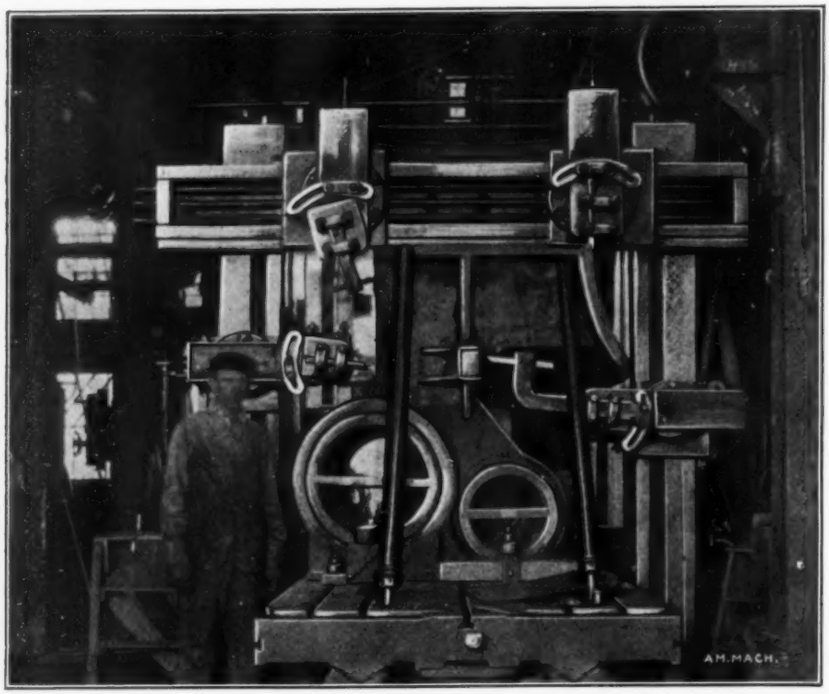


FIG. 1. PLANING A DIFFICULT CYLINDER SADDLE

PLANING LOCOMOTIVE CYLINDERS

To anyone wishing to become familiar with the possibilities of a modern planer using four tool heads, there is probably no better opportunity than in planing some of the many styles of locomotive cylinders, which are cast with half saddles, as is usually the case.

There are so many cylinder designs that it is impossible to give any standard; one of the many methods is shown in Fig. 1. This is not the most complicated setting, but at the same time it gives a fair idea of what locomotive builders, and those who make repair parts, have to contend with in this line. This is a Cincinnati planer equipped with four heads, all of which are at work, and very very little explanation is required if the illustration is carefully studied.

The right-hand side tool head carries an L-shaped tool holder. This brings the planing tool into position to reach the cylinder's casting, and to plane the bearing spots for the upper half of the forward frame. The other side head is planing for the lower half of the same frame, while the two upper heads are taking care of the joints between the two halves when they are bolted together. Although not altogether unusual, it is an excellent example of what can be done in planer work of this kind, and illustrates how the bores of the cylinder and piston valves are lined up, and also how the thrust of the tool is taken by the angular braces which come down to the table.

CYLINDER BORING AND LAYING OUT

Some of the larger work handled in this shop is shown in Fig. 2. The machine at the left is at work on the bore of the low-pressure cylinder of a Vauclain balanced compound locomotive, while the machine at the right is boring the valve chamber for a piston valve triple engine.

The work-holding tables of these machines differ from those usually supplied and were largely designed by Mr. Muchnic, who was formerly at the Topeka shops of the Santa Fé. These tables are very substantial and allow easy adjustment of the cylinders from one to the other, as is especially noticeable in the one boring the cylinders for the balanced compounds.

The way in which these cylinders are laid out can easily be seen by referring to Fig. 3, which is a view of a large layout table conveniently located for the boring machine, so as to save undue handling of the heavy parts. As will be

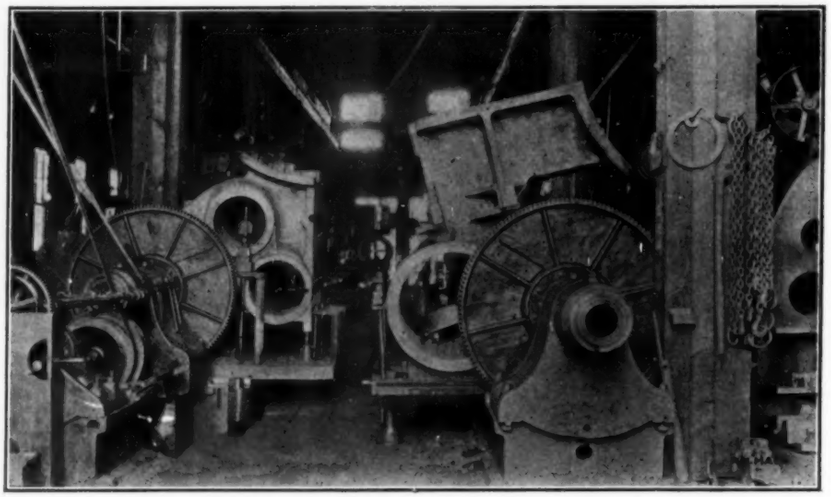


FIG. 2. BORING CYLINDERS AND VALVE CHAMBERS

seen this layout table consists of a very heavy cast-iron plate, substantially mounted on a masonry foundation, and is being used for laying out cylinders. This enables the surfaces to be planed to be laid out accurately from the cylinder bore, and insures the cylinder castings

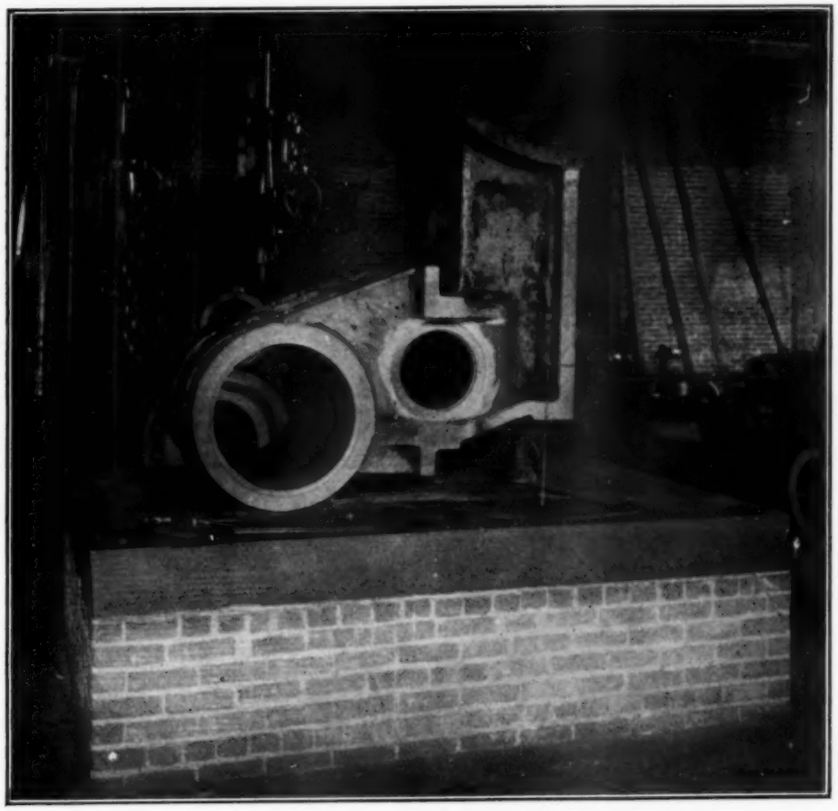


FIG. 3. THE LAYING-OUT TABLE

FIG. 4. SOME OF THE PARTS MADE FOR STOCK

fitting into place after they have been machined.

Some idea of the variety of locomotive parts, sufficiently standardized to allow duplicate parts to be made in a manufacturing shop, is shown in Fig. 4. This includes valve-chamber bushings, piston heads and rings, valve-chamber heads, piston heads, drive-pipe connections, and a variety of other pieces.

MILLING PORTS IN VALVE BUSHINGS

An interesting device for milling the ports in piston valve-chamber bushings, is shown in Fig. 5. This device is mounted under a large radial driller, having a small, short milling cutter mounted in the end of the spindle. The valve bushing is clamped between the two supporting heads shown. The head at the right carries a wormwheel for rotating the bushings under the milling cutter, in order to mill the sides of the slot or ports.

After the bushing has been turned in the lathe, a small parting tool is used to locate the edges of these port openings, so as to form a guide in having them milled. The operator brings the milling cutter down into the port, mills across the end by moving the head along the arm, and then throws in the worm feed through the gearings at the front. This rotates the bushings and mills the side of the slot. Then the end is finished in the same way as the first, and the bushing revolves in the reverse direction to finish the other side of the port.

The bushing can also be revolved by hand to any desired point, by using a crank on the end of the square shaft shown at the front of the worm gear, and the handwheel. All movements parallel with the axis of the bushing are obtained by moving the driller head along the arm while all the rotating movements of the bushing are secured by the double worm-gearing in the device itself. This works very satisfactorily, but a special machine is being designed and built so as to do this work without monopolizing the radial drillers.

TURNING PISTON VALVES

Piston valves are not easy to drive when turned between centers, and this is necessary in order to have both ends of the valves true with each other. The very simple device shown in Fig. 6 for driving piston valves has been used long enough to prove that it is entirely satisfactory and can be handled much more rapidly than any clamping arrangement for work of this kind.

The valve casting is carried on substantial centers and the chain shown is simply wrapped around the end nearest the face-plate, the end of the chain being fastened to the straps bolted to the face-plate by the hook shown. While this would not be apt to work satisfactorily on a finished piece, it holds admirably on the rough casting and drives the valve heads perfectly. The ends are turned and grooved with special tools to secure both uniformity and rapid production.

KEEPING TRACK OF MACHINE TOOL WORK

One of the interesting features of this shop is the method by which the superintendent keeps track of what is going on by means of what is known as a machine dispatching board.

This is very similar to the regular system for dispatching work, except that it is used entirely to keep track of the work being done on various machines in the shop. The board hangs conveniently on the wall behind the superintendent and is divided into sections representing the different machines in the shop. Each section is numbered to correspond with the name of the machine and has a hook

on which cards are hung, showing exactly what work is being done on the machine in question. If no job is assigned to the machine, it is marked as being idle.

The cards which are hung on the hook show the work done by each machine during the day, thus giving the superintendent a record of the production of each machine, while the daily time card shows what has been done by each man. This is of considerable assistance in assigning work, as it can be seen at a glance exactly what machines are available, so that it is very easy to plan the machine which can be used for any particular job which may come along, without going into the shop or consulting the foreman or operator.

Standard Railroad Parts

It is both interesting and gratifying to note the increasing use of standard parts on locomotives, such as piston rings, pistons, cylinder and valve bushings and similar pieces. This allows material of this kind to be made up in quantity and at a manufacturing price, so that it can be sold to the railroads at a lower figure than it can be made for in the average shop. This is on exactly the same principle as buying of small handles and standard bolts and tap screws by machine-tool builders, from those who make a specialty of this work, and is not in any sense a criticism on the ability of the small railroad shop.

This shop also makes a great many locomotive standard cylinders and saddles, to be used in repair work on locomotives operating on railroads in this vicinity, these including both cylinders for balanced compound locomotives and also for Vauclain compound, a few of these still being used on the Santa Fé and other roads in the territory. The list includes both piston and slide valves, and altogether makes a business of considerably larger volume than might be supposed.

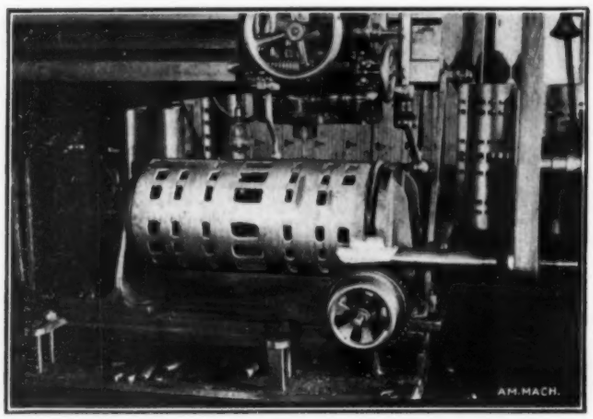


Fig. 5. Milling Valve-bushing Ports

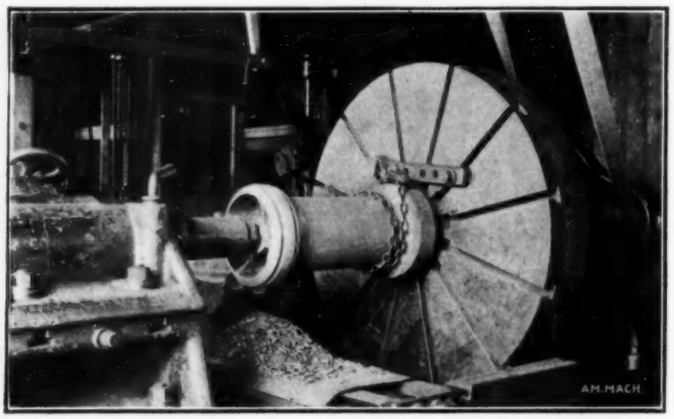


Fig. 6. Driving Work with a Chain

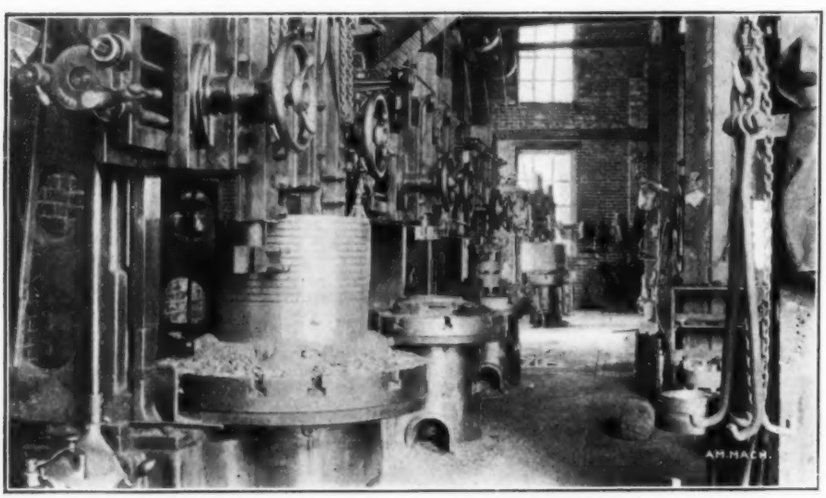


Fig. 7. The Battery of Boring Mills

This shop provides one of the best examples of the use of boring mills to be seen anywhere. This, of course, is because nearly all of their work belongs in the plate class, and it is interesting to note the extent to which the lathe has been left out of the question. The view shown in Fig. 7 gives an idea of one of the boring-mill departments, the other departments being equally large and all the mills being of the Bullard make.

Bushing Holes in Planer Fixtures

Some of the fixtures used in planing driving-box shoes and wedges are shown in Fig. 8. As will be seen, these are planed in long strings, which helps to secure economy of production. It will also be noticed that the fixtures on the further

Fig. 8. Planer Fixtures with Bushed Holes

side of the planer bed have all the holes bushed around the holding screws.

Any holding fixture which is used frequently is bound to wear quite rapidly in the screw hole, especially when this is cast metal. The usual plan is to tap these holes out to a larger size, repeating this operation until the screw becomes too large to be convenient.

To obviate this difficulty, fixtures are now made with machine-steel bushings screwed into them, as shown. This bushing carries the holding screw. In case of extensive wear it is only necessary to unscrew the worn bushing and replace it with another, these being made in quantities at a very low cost. This makes a very practical solution of a very common difficulty, and has proved eminently satisfactory in this shop.

Screw Spikes on the Panama Railroad

EDITORIAL CORRESPONDENCE

Anyone who imagines that the Panama R.R. is to be compared with what one usually expects to find in such an out-of-the-way place, he is very apt to be mistaken. And, unlike many other railways in similar locations, it has paid from the beginning.

The charter was secured way back in the '40's and those who engineered it were not at all bashful in securing what might easily be called a liberal concession.

While the exact wording is not at hand, it is understood that the charter not only prohibited the building of a parallel railroad, but also made it impossible to build any other kind of a road, even for carriages, across the Isthmus. This was so effective that for many years the old Spanish trail from Porto Bello to Old Panama, which was blazed through the jungle by Pizarro so long ago that it makes us seem old to even think about it, was the only other semblance to a road within many miles. There were, of course, native trails between villages, but it is only since the advent of American control that there has been anything which might be likened to a good highway.

Furthermore, it was against the law to walk on the company's right of way and, except for those who were particularly familiar with the whole section and could follow a trail, it was a case of paying $10 gold for a single passage from Colon to Panama or *vice versa*, with all baggage charged at an additional rate. When it came to giving iron-clad concession which completely ignored the right of both present and future generations, the government of the United States of Colombia seems to have been past master.

PUTTING IN THE SCREW SPIKES

This railroad has always been a money maker and was in good condition when taken over by the Isthmian Canal Commission. At present they are trying out the screw spikes, as can be seen from the accompaying illustration, the work being done by one of the gasoline Au-tra Kars, made by the Au-tra Kar Co., Atchison, Kan. This car was designed by H. W. Jacobs, assistant superintendent of motive power, of the Atchison, Topeka & Sante Fé Ry., for inspection use and is also fitted with the screw-spike driving attachment, as shown. Holes are drilled with the same device and the spikes screwed into place easily and rapidly, the car being moved from point to point by its own power and carrying the construction or repair gang with it. These are driven by power obtained from the same engine which guides the car and it makes a good test of an air-cooled motor to have it run continuously on work of this kind in a tropical climate.

The large pipe which will be noted running beside the track behind the car is a 10-inch pipe and forms a part of the compressed-air pipe line, which is said to be one of the largest compressed-air installations in the world.

DRIVING SCREW SPIKES ON THE PANAMA R.R.

Job Records for the Selling Office

BY J. V. WOODWORTH

In the district offices of a large contract machine and tool manufacturing company, the stories of all business are made up and filed so as to be comprehensive histories of the entire evolution from the time the work is discovered until the order is secured or lost. When an inquiry or request for an estimate is received at a district office, an "Original" white slip like Fig. 1 is made out. After acknowledgment of the inquiry, a yellow "Progress" slip, Fig. 2, is filled as shown.

In the event of the estimate being satisfactory, and upon receipt of the order at the district office, a "Final" pink slip, Fig. 3, is made out. Thus the whole story is covered and may be consulted at will for any details regarding the particular job, about which information is desired. The number of "Progress" slips varies, according to the time required to secure orders, number of interviews with the prospective customer, etc. These stories at the end of the year give the active history of the business done and the earnings of the district offices.

Form 1-2

ORIGINAL

Date.....191 INQUIRY NO.....
Name, ...
Address, ...
Origin, ...
Rating: Brad..... Dun.....

DETAILS

Fig. 1. INQUIRY SHEET. 8½x5½ in.

Form 2 9-1-6000

PROGRESS

Date.....191 INQUIRY NO.....
Name, ...
Address, ...

DETAILS

Fig. 2. PROGRESS SHEET. 8½x5½ in.

Form 3

FINAL

Date.....191 INQUIRY NO.....
Name, ...
Address, ...

DETAILS

Fig. 3. FINAL SHEET. 8½x5½ in.

Out of 240,000 miles of railway in the United States, only 71,000 miles were operated under the block system in even its most elementary form, a year ago. The increase of block-signal mileage in 1910 was only 5500 miles, or less than 3 per cent.

Moon Motor Car Jigs and Fixtures

Western Correspondence

Simple and efficient tools for enabling crank cases to be faced on the miller, drilled under the multi-spindle machine, and bored on the engine lathe.

Cylinder jigs, tools for boring brackets on the lathe, and fixtures for milling hangers, covers and other parts.

The accompanying halftones illustrate a few of the special tools used in the Moon Motor Car Co.'s shop, at St. Louis, Mo.

Crank-case Operations

Two milling operations on aluminum crank-case bottoms or pans are represented in Figs. 1 and 2. The first of these views shows the casting on the table of a Garvin miller with vertical spindle and with a 14-in. inserted-tooth cutter passing over the upper face of the work. The casting rests with its flange upon suitable supporting screws, and thumb screws at the side locate it sidewise against stops at the rear of the fixture.

It is held down in position by straps at each end. The fixture is open along the sides and ends and is easily kept free of chips. The view in Fig. 2 shows the aluminum casting on the table of a Brown & Sharpe miller, with a 6-in. face in operation on a pad at the side of the work.

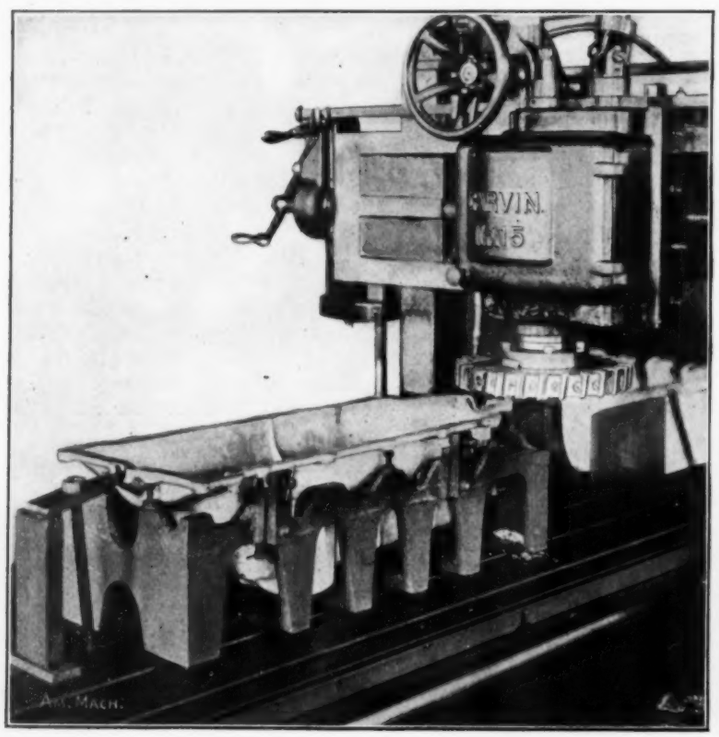


Fig. 1

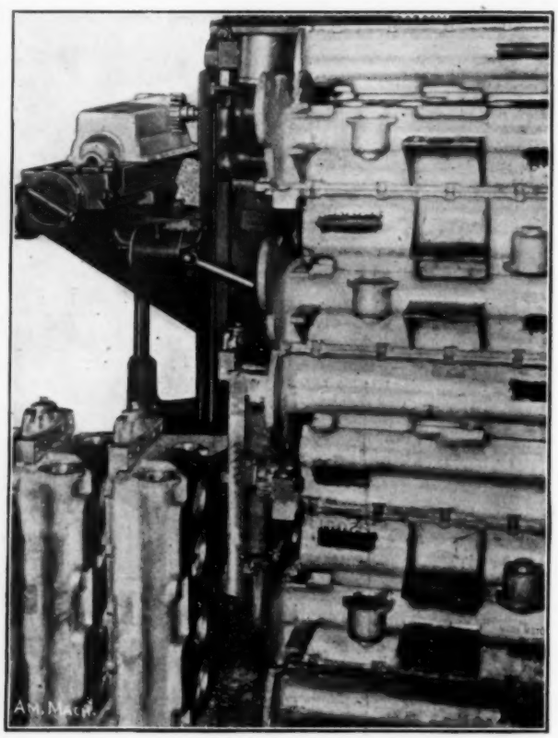


Fig. 2

Milling Aluminum Crank Cases

Boring and Drilling

The boring fixture on the Barker lathe, in Fig. 3, carries three bars for boring crankshaft and camshaft bearings in the crank cases after the caps have been attached. The three bars are mounted in two brackets which fit the lathe shears, and they are geared together so that with the upper bar driven from the lathe spindle the other two rotate in unison.

Each bar carries three cutters, against which the three bearing walls of the case are fed by the traverse of the carriage, upon which a suitable fixture is bolted for supporting the work. The crank case is drilled with a plain jig, Fig. 4, in a Gardam multiple-spindle machine. The driller is shown set up for putting through the holes for the vertical-pump shaft. This jig is used also for drilling the 12 stud holes for the cylinder bases and for certain other holes in the crank case.

Some Cylinder Work

The different flat surfaces of the cylinders are finished by milling and one of these processes is represented by Fig. 5, which shows the method of facing the seats at the sides of the cylinders with a Garvin duplex miller. The cylinders are cast in pairs and four castings are placed on the miller table at once.

The boring and facing of the valve-cage openings in the cylinders are accomplished with the aid of a jig, which is illustrated in Fig. 6, as used under the Gang radial driller. The jig shown is fitted with six bushings, but in handling the type of cylinder in this view, only four of the bushings are required.

The boring and facing tools for this work are carried by short bars, which are guided accurately in the jig bushings. The work is held by simple screws and stops and little effort is required in placing the cylinder in position for machining, or in removing it upon completion of the boring operations.

Milling Engine Hangers

The operation in Fig. 7 is the milling of the central pad of an engine hanger for the reception of the crank case. The surfaces at the ends are also milled at the same setting and with the same cutter. The overall distance is tested with the gage shown in the foreground.

The fixture is used on the table of a Cincinnati vertical miller and consists of a pair of brackets, through the walls of which screws are tapped for clamping the hanger firmly by the web. The depressed

portion of the hanger rests upon a parallel and is strapped down to add rigidity at this point and prevent springing under the action of the cutter.

Boring Camshaft Brackets

Figs. 8 and 9 represent two operations in boring right-angle bearings in camshaft brackets, the work being carried on a fixture fitted to the faceplate of a Bradford lathe.

Before the castings are brought to the lathe the caps have been fitted, and the two bearings for camshaft and pump shaft must then be bored in the lathe at right angles to each other by placing the assembled bracket upon a swivel block on the faceplate fixture. The holding fixture is referred to as the swivel block for the reason that it admits of adjustment about its trunnions to the desired positions, although as a matter of fact, the setting of this block is not altered during the running off of a lot of work, until the first boring operation has been accomplished in the entire series of brackets, after which the block is reset and the second bearing bored in the whole lot of pieces.

The two views show the work holder and the work in the two different settings. It will be noticed that the block with its trunnions is located in bearings formed in the projecting portion of the fixture, and is securely fastened in place by a nut on a stud run in through the bottom. In resetting for the second operation on the lot of brackets, the block is released and turned over on the other working face and reclamped. In each operation the work is fastened rigidly to the face of the holding block and rests against a stop screw.

The holes are cored out in the work and a chucking drill may or may not be

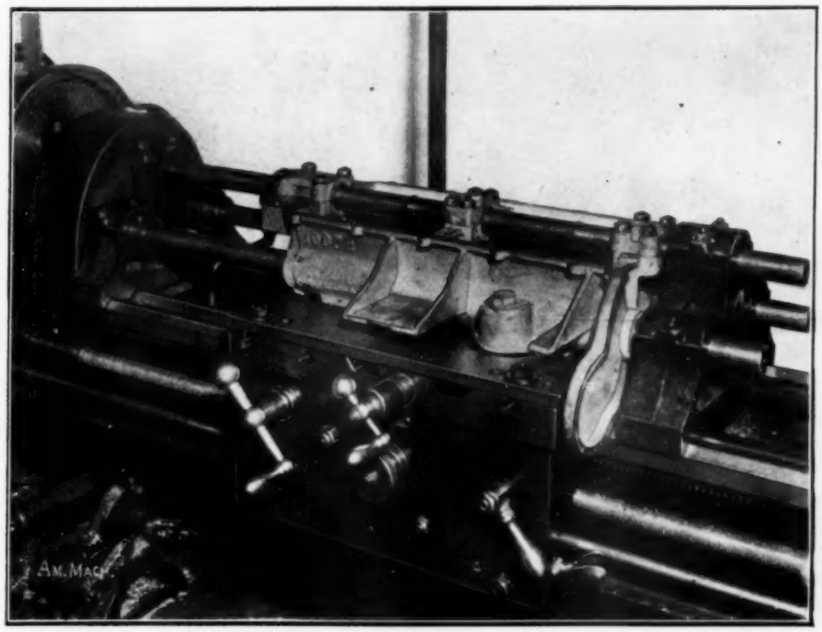


Fig. 3. Boring Crank Cases in the Lathe

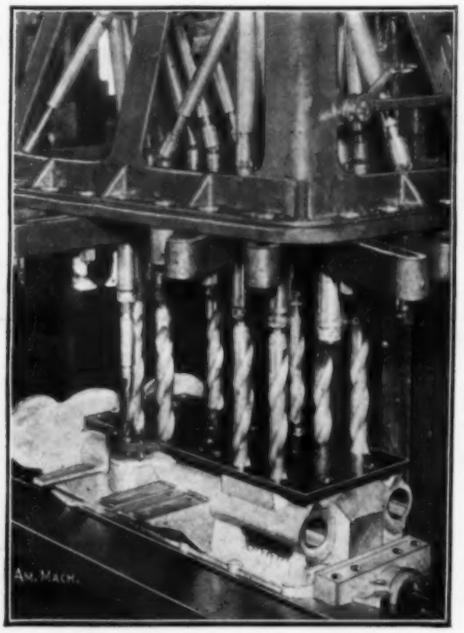


Fig. 4. Drilling Crank Cases

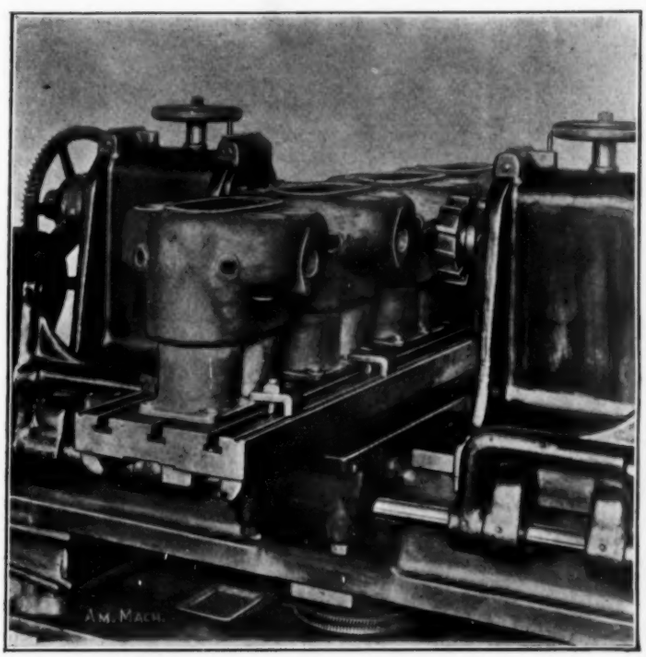


Fig. 5. Milling Cylinders

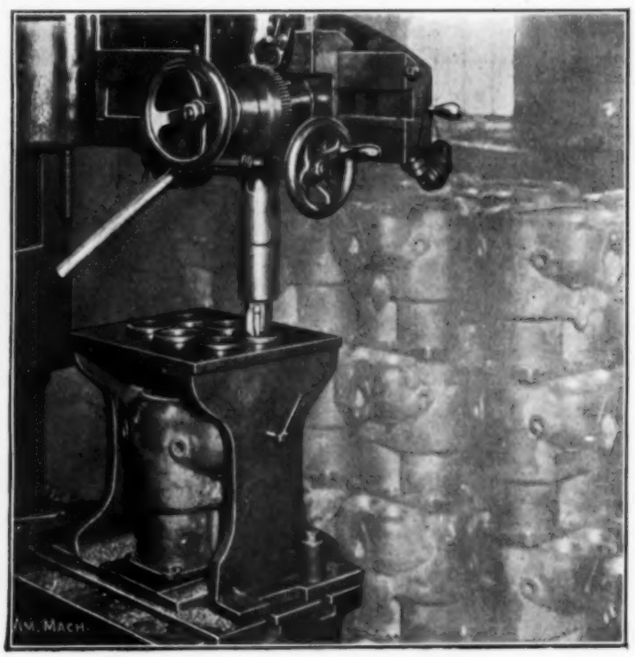


Fig. 6. A Cylinder Jig

used in the tail spindle for roughing out the bore of the casting, according to the condition of the rough hole. In any case, the single-point boring tool in the post takes the finishing cuts, and where there is not too much metal to remove, a single-point roughing tool is applied in the same manner.

Other Tools

The tools in Fig. 10 are: *A*, a fixture for holding pipes while the flat surfaces are being milled; *B*, a miller fixture for cylinder-cover pipes; *C*, a drill jig for roller tappet guides. The first of these tools locates the work with the flanges between stop pins, and pressure screws tapped through straps across the top of the fixture force the work down tight and steady it during the milling operation. Fixture *B* has a pair of stop pins for the end of the cylinder cover, and setscrews at the side hold the work down in its seat.

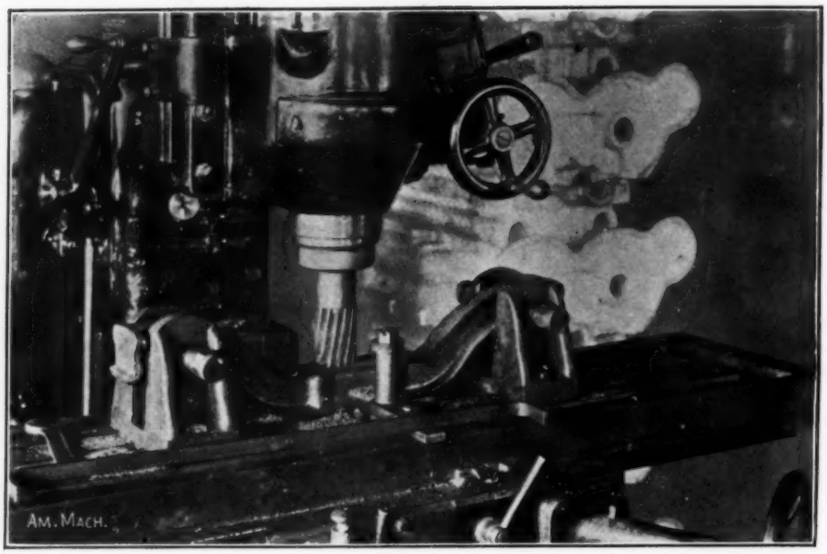


Fig. 7. Milling Engine Hangers

Fig. 8

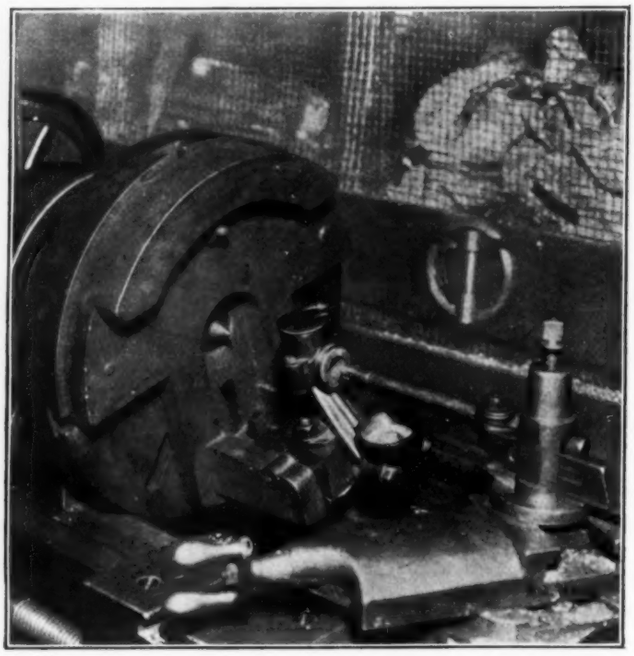


Fig. 9

Boring Fixture for Camshaft Brackets

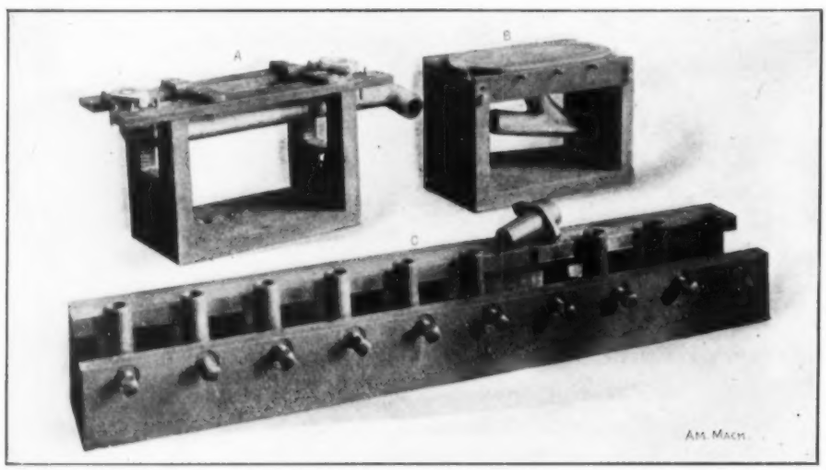


Fig. 10. Milling Fixtures and a Drill Jig

The jig at *C* holds 10 tappet guides for drilling and reaming under the multiple-spindle machine. The jig is an open affair without guide bushings, and the castings to be drilled are located in V-notches formed in the top and bottom walls to hold the work vertically. One setscrew clamps each casting in place in these notches.

There are few more contemptible swindles than those which induce mechanics and others to spend time and money to seek better positions, where none exist. When alluring advertisements of this kind appear it is always well to verify them by correspondence with reliable parties in the vicinity, who can usually be reached with a little effort.

Design of a Punch and Shear

By N. Leerberg

Method, factors of design, and simple formulas used in designing a combination punch and shear.

Combination punches and shears of the type taken up in this article are used to a great extent in European shops. There, the frames are usually made of structural steel for the sake of lightness. In shops where the machines are placed permanently lightness is of small importance, and the additional weight resulting from using a cast-iron frame is to be preferred, for its use cheapens the process of manufacture and gives a more graceful appearance.

A similar machine was being manufactured by a Western shop well known for its line of sheet-metal working machinery. It had a frame made of a heavy web with angles bolted to the sides for feet; this made a bad looking arrangement. Owing to other imperfections the problem was entirely reconsidered in the present design. A general idea of the machine may be obtained from the assembly drawing, Fig. 1, which clearly shows the punch, the plate shear, the angle shear, the bar shear, and the method of actuating these. The machine will punch a ¾-in. hole in ¾-in. boiler steel, or, if a helical punch is used, a 1-in. hole in ¾-in. steel. For such work the speed may properly be 35 strokes per minute. Making allowance for dull tools the pressure exerted on the punch is:

$$P_m = 1.1\, d\pi t S = 107{,}000\ lb$$

where

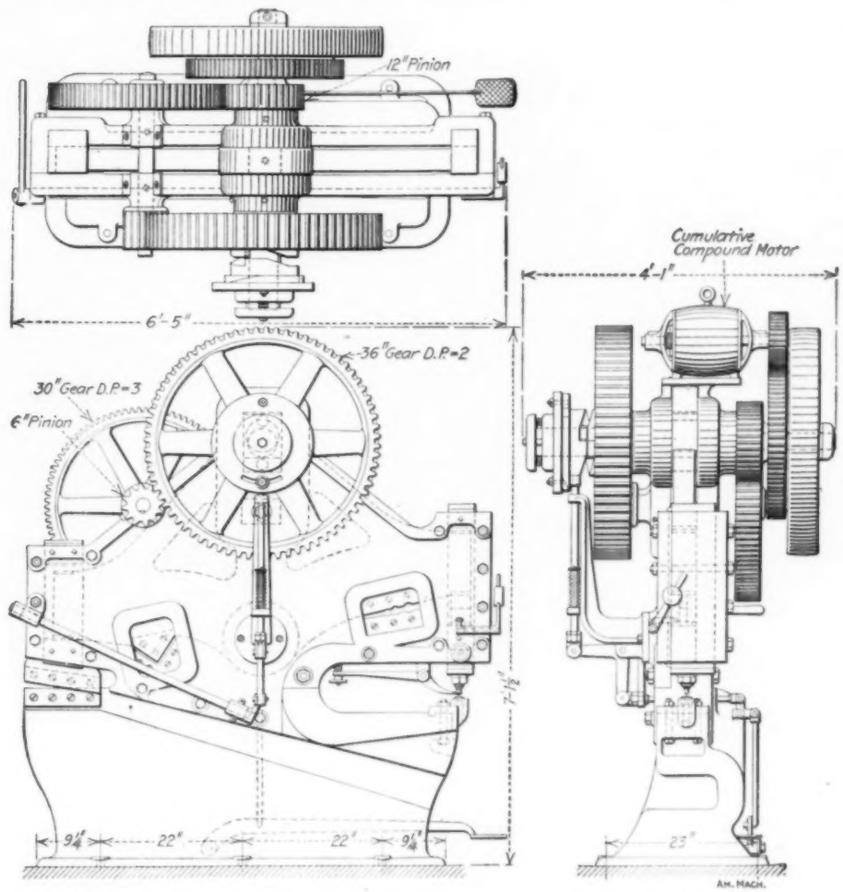


FIG. 1. GENERAL ASSEMBLY OF COMBINATION PUNCH AND SHEAR

d = Diameter of punch,
t = Thickness of plate,
S = Shearing strength of the steel.

DIAMETER OF CRANKPIN

This force is transmitted to the pivot where, due to the slow oscillating motion, the coefficient of friction is about 0.1. Therefore, since the rocker has equal arms, the force exerted by the crankpin is nearly 108,000 lb. Textbooks on machine design usually give a maximum bearing pressure of 3000 lb. per sq.in. This, however, would result in a very large pin. German practice, according to E. Kühne, allows 4250 lb. per sq.in., and American practice goes considerably higher. Oberlin Smith, *Trans. A. S. M. E.*, 1905, mentions a punching press of 84 tons capacity in which the eccentrics exert a pressure against the pitman of 7000 lb. per sq.in. With these values a 5-in. pin may well be used, as this will also be safe against bending and shear. The motion is slow and intermittent so that the lubricating facilities are excellent. A bearing pressure of 5000 lb. per sq.in. may be considered safe; but wherever possible a smaller factor should be used. The ends of the shaft must be designed for combined bending and torsion, formulas for which are found in any standard handbook.

The power requirement of the machine may be roughly calculated by considering the maximum pressure to act through one-third the thickness of the sheet. At this time the fibers are all sheared off, and the remaining resistance is largely due to the friction of the fibers against each other. But if an exact calculation is desired a different method must be employed. The following method is taken from E. Kühne, in "*Zeitschrift der Vereinigte Deutsche Engineure.*" In the present case a stroke of 2 in. was desired. The understroke was ¼ in., from which the overstroke becomes 1 in. Draw a circle representing the path of the crankpin to full size (see Fig. 2). The work will then be done through the angle from 90° to 138° 35'. Let

β = The increment of the angle beginning from zero,
r = The radius of the path circle,
x = The corresponding path of the punch.

Then,

$$\cos.\ \beta = \frac{r - x}{r}$$

whence

$$x = r\,(1 - \cos.\ \beta)$$

The second column in Table 1 gives the values of x for increments of β. As the punch enters the sheet the pressure is diminished, and is at any time equal to

$$P = 1.1\,\pi d t_0 f_m$$

where f_m is the maximum force exerted upon the crankpin (108,000 lb.), and t_0 is the difference between the sheet thickness and the penetration of the punch. But it is the tangential force which determines the power consumption. At any instance the tangential force is:

$$T = P \sin.\ \beta$$

the values of which are shown in the

fourth column of Table 1. The cutting speed is equal to $v \sin. \beta$, where v is the uniform rotary speed of the crankpin.

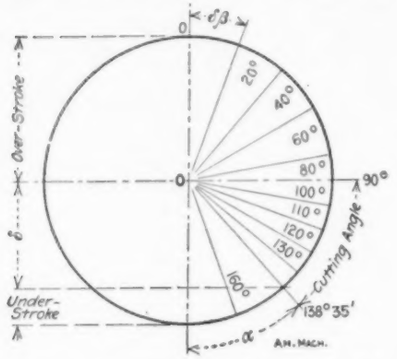


FIG. 2. DIAGRAM OF A PUNCH CYCLE

As before the tangential resistance is

$$T = P \sin. \beta$$

From this relation Table 2 may be computed.

Angle in Degrees	Load in Pounds
277	99,500
290	94,000
310	76,700
330	50,100
350	17,340

TABLE 2. TANGENTIAL RESISTANCE CORRESPONDING TO VARIOUS ANGULAR POSITIONS IN SHEARING

THE HORSEPOWER REQUIRED

With the data from Tables 1 and 2 as ordinates and the developed crankpin path as abscissa the diagram, Fig. 3, is constructed. The mean cutting speed is found to be 2.295 in. per sec. with a maximum speed of 2.68 in. per sec., a speed which is within very reasonable limits. It is seen at a glance that the shearing operation requires the greater power. The two shaded areas represent 10,120 ft.-lb. per revolution, or 354,200 ft.-lb. per min.

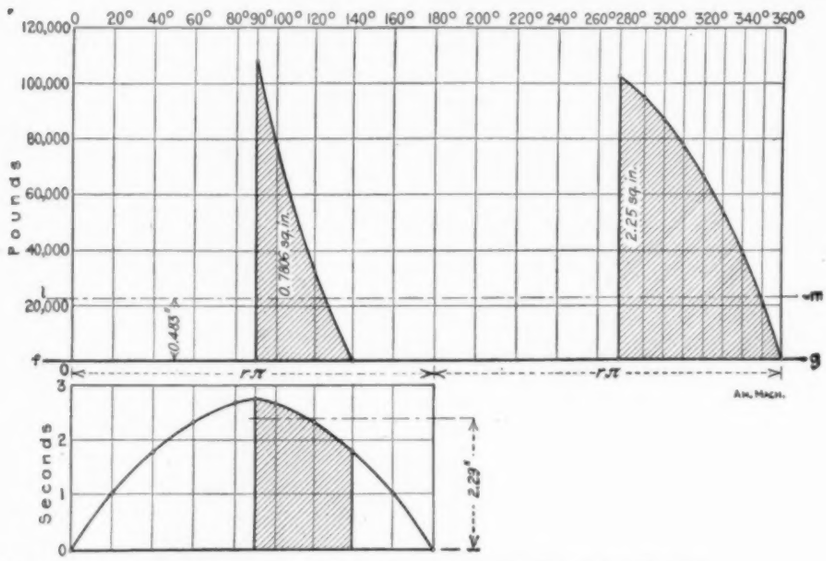


FIG. 3. DIAGRAMS SHOWING WORK FOR PUNCHING AND SHEARING CYCLES

In tabulated form the data appears like Table 1.

β In Degrees	Punch Path, x In Inches	Normal Resistance, P In Pounds	Tangential Resistance, T In Pounds	Cutting Speed, c Inches per Second
20	0.06031	0	small	0.896
40	0.23396	0	small	1.685
60	0.50000	0	small	2.270
80	0.82635	0	small	2.580
90	1.00000	107,975	107,975	2.680
100	1.17365	83,400	82,000	2.580
110	1.34202	58,900	55,400	2.460
120	1.50000	36,000	31,200	2.270
130	1.64279	15,400	11,800	2.080
138° 35'	1.74992	small	small	1.730
160	1.93969	small	small	0.896
180	2.00000	small	small	0.000

TABLE 1. TABULATED DATA FOR A WORKING CYCLE OF THE PUNCH

The foregoing calculations determine the power requirement of the punch, but since the shear may require a greater power it is necessary to make further calculations. The maximum pressure in shearing is

$$p = k_w \times 1.4\, t^2$$

where $k_w = 1.7$ times the shearing strength of the steel.

$$\frac{354,200}{33,000} = 10.73\ hp.$$

The foregoing treatment considers that every stroke is utilized. In practice this is not possible. The motor can stand a high occasional overload if it is running idle at intervals, allowing the heat to radiate. The possible power reduction cannot be determined except by a close study of the work in question. Having determined the cycle, the motor may be determined by the "Root mean square method." Assume the following cycle:

Horsepower		Time in Seconds	
1.6	.....	10	motor running idle
10.7	.....	1	decelerating
16.0	.....	5	accelerating
10.7	.....	2	full speed
Total	.....	18	

Squaring the horsepower values and multiplying by the number of seconds gives the following:

$(1.6)^2 \times 10 =$	25.6	hp. squared seconds
$(10.7)^2 \times 1 =$	114.5	hp. squared seconds
$(16.0)^2 \times 5 =$	1280	hp. squared seconds
$(10.7)^2 \times 2 =$	229	hp. squared seconds
Total...	1649.1	hp. squared seconds

When the motor is at rest it can radiate heat only half as fast as when running. Likewise, during acceleration or deceleration the radiation is three-fourths that of full speed. Therefore the periods of acceleration and deceleration are the given values of 3¼ and ¼ sec., respectively, while the period of rest is equivalent to 5 sec. On this basis the length of the cycle is 11.5 sec. Now the sum of the products hp. sec.^{2} is divided by 11.5.

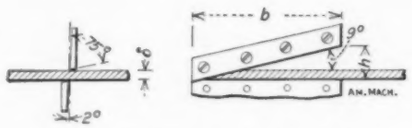


FIG. 4. PROPORTIONS OF BLADES OF ALLIGATOR SHEARS

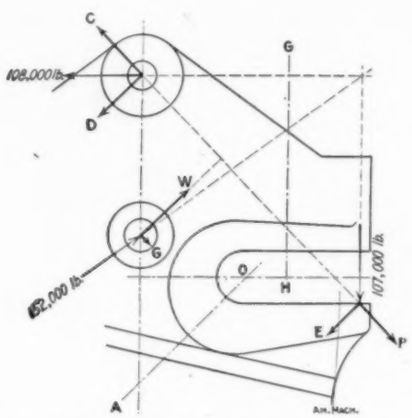


FIG. 5. DIAGRAM OF FORCES ACTING ON THE FRAME

$$\frac{1649.1}{11.5} = 143.4$$

The root of 143.4 = 12, which is the motor power required. It is seen that the cycle assumed is inefficient. A more efficient cycle could be obtained by trial. However, the output is the first, while the power consumption becomes the secondary consideration.

For such work it is best to use a cumulative compound motor if direct current is to be used, or the proper type of induction motor if alternating current is to be used. Such motors will automatically slow down when heavy resistances are encountered. It is customary to allow 20 per cent. reduction in speed. Under this condition the ordinary motor would be a dangerous appliance.

THE CRANKSHAFT AND JAWS

The crankshaft involves nothing new. It is, however, well to calculate the bend-

ing moments produced by the gears, and then to determine the equivalent bending moment according to the formula:

$$Meb = 0.35\ Mb + \sqrt{0.65\ Mb^2 + Mt^2}$$

The gears should be designed by Wilfred Lewis' formula, which may be found in any handbook.

The customary proportions for the alligator shear are given in Fig. 4. The angle may vary from 9 to 12 degrees, but above that the knives refuse to bite.

The action is by no means pure shear. At first the top fibers are depressed. The rounded corners which thus result act as wedges, forcing the knives apart with great intensity. According to "Hütte," Vol. 1, page 419, the horizontal force tending to spread the knives is,

$$\frac{3}{2}\frac{Q}{F}$$

which means that the force is 1½ times as great as the force required for shearing.

The Frame

In designing the rocker arm (shown dotted on the assembly) it is well to bear in mind that all forces travel in straight lines. The metal must, therefore be placed where it is most needed; that is, along straight lines connecting the points of application of the forces.

The frame presents a rather peculiar problem; which is especially true of the punch frame. The best theory for curved members is that developed by Andrews and Pearson, and very ably discussed by Professor Rautenstrauch. But the peculiar section of the frame renders this theory very difficult of application. If the unit stress is taken quite low the oblique beam theory may well be used. Reference to Fig. 5 gives an analysis of the forces for the section $O - A$. The punching resistance is broken up into its components E and P. Likewise the force on the crankshaft is equivalent to $C + D$. Also, the pivot reaction is $W + Q$. It will be seen that C is not equal to P; but the action of the force Q is to neutralize C and P. Since action is equal to reaction it is evident that this is the case. Now, if the forces D, W and E are transposed until their points of application come on the neutral axis of section $O - A$ we have in effect a beam obliquely loaded.

The offset frame which the splitting shear necessitates renders the section rather peculiar; the more since the neutral axis comes near the offset. But since the neutral axis is a line of no stress it is well, if possible, to choose a section that will have its axis in the offset. The neutral axis may be determined experimentally by cutting a cardboard section and balancing this on a knife-edge. Mathematically it is found from the formula,

$$x_0 = \frac{F_1 x_1 + F_2 x_2 \ldots\ldots}{F_1 + F_2 \ldots\ldots}$$

in which F is the area of each element of section and x is the distance of its gravity axis from some arbitrary line of reference.

The moment of inertia is best found mathematically by calculating the moment of inertia of each elemental section with regard to its gravity axis, and then transposing to the neutral axis of the entire section by the formula,

$$I_z = I_g + F d^2$$

The total tension per unit area is made up first, of straight tension due to the forces C and P, second, of flexure from the forces C and P with their distance from the neutral axis as a moment arm, third, from flexure from the eccentric load W with D and E as reactions.

Particular attention is called to section $G - H$. It might at first appear that the tendency would be to spread the punch opening. But such is not the case. Due to the absence of the forces E and P from this section the force W becomes dominant, tending to close it. Appearance, then, becomes the deciding factor for this section.

Nothing needs to be said of the remaining sections. They are in substance identical with the foregoing examples.

Diameters of Punch and Die

By using a structural punch jaw, angles may be punched on both legs without turning the lengths end to end. Small points like these often determine the commercial success of a machine. The dimensions of the punch and die are as follows:

Let

d = Diameter of hole,
d_1 = Diameter of punch,
d_2 = Diameter of die,

then, when the machine is worn,

$$d_1 = d - \tfrac{1}{15}\,d$$
$$d_2 = d + \tfrac{1}{15}\,d$$

when the machine is in good condition the last term is replaced by $\frac{1}{20}\,d$.

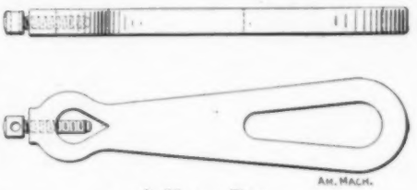
This article might be greatly amplified, but it is sufficient for the purpose. It may be noted that the frame was considered as a single casting. The side was then secured with turnbolts so as to make it equally strong. Rigidity is an absolute necessity. Experience taught that the slightest amount of flexure would throw the shafts out of line and cause unlimited difficulties.

The completed statement of the American Iron & Steel Association shows that the total production of pig iron in the United States in 1911 was 23,649,344 long tons; a decrease from 1910 of 3,654,223 tons, or 13.3 per cent. The production for the second half of the year was 11,982,348 tons, being 315,352 tons more than in the first half. In 1910 there were 14,978,738 tons made in the first half and 12,324,829 tons in the second half of the year.

A Hand Dog

By S. Victor Brook

Frequently a very useful tool is also a very simple one. The little hand dog shown in the illustration is an example of this. The uses of this tool are numerous. It may be used for holding a



A Hand Dog

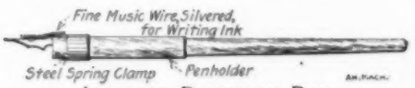
large variety of drills when drilling in a bench or small engine lathe. It is also very handy for holding small round stock while centering. In short it does most of the work of a common lathe dog.

The body and screw should be hardened. An attractive appearance may be given it if in hardening a mottled effect is added, provided it is machine steel. The handle may be made solid or skeleton, as shown. The screw may be made as shown or in the form of a thumb-screw. This tool is a good addition to any tool maker's equipment.

Another Reservoir Pen

By George M. Meyncke

I have been using a reservoir pen for five or six years; I think it better than either of those described on pages 702 and 1045, Vol. 35. It has the advantage of being equally useful for writing or



Another Reservoir Pen

india-ink work. The flow of ink to the point can be regulated by sliding the coil up or down on the penpoint. While the coil can be made of steel music wire for india ink, I made mine of silvered banjo strings, so as to use them with any kind of ink. The penpoint can be removed by sliding the coil up out of the way.

There is probably more trouble with cylinder heads than any other known thing in the mechanical construction of a gas engine. Some of these difficulties are leakage, trouble with gaskets, distorted valve seats, distorted valve guides and poor castings. These troubles are due in part to poorly distributed metal, one portion of the head being of a much heavier construction than another portion, or the walls of passages are allowed to intersect unnecessarily, forming large lumps of metal. If the exhaust valve of the exhaust passage is not surrounded by water, there will be trouble.

An Interesting Shop in the Tropics

By Fred H. Colvin

Diversity of the work handled in the plant of the Havana Drydock Co. Some of it accomplished with primitive methods and highly satisfactory results. Sugar mill repairs predominate. Some of these described in detail.

One of the most interesting shops in the vicinity of Havana, Cuba, is that of the Havana Drydock Co., situated at Regla. This is a ferry ride from Havana. The boat on which the trip is made is the "West Brooklyn," showing that in spite of the prefix, the boat had once done duty in New York Harbor.

Some idea of the variety of this company's work can be had from Fig. 1, which shows a settling tank for a sugar mill in the foreground and a pleasure yacht tied up against the wharf in the distance. In between these are all sorts of work, including considerable oxyacetylene repairing of electric-motor frames and machinery of various kinds.

They have their own foundry for both iron and brass, the latter consisting of two oil furnaces of 100 and 1000 lb. capacity, respectively, as well as a well equipped blacksmith shop and a department devoted to sheet-metal and plate work. The tank shown in Fig. 1 is approximately 20 ft. long, which will give something of an idea of the size of work handled. The sugar mills in the vicinity of Havana naturally furnish a substantial proportion of the work, a crushing roll from one of them being shown in Fig. 2. These are about 8 ft. long and perhaps 40 in. in diameter.

As can be seen, the keyways are being planed, a substantial extension head being fastened to the tool block, and reaching inside the bore a sufficient distance to plane through the end into the chamber in the center. Another good-sized job is shown in Fig. 3, where a large journal bearing for the shaft carrying the crushing rool is being fastened to the faceplate of a large lathe to be bored and faced. It is being held against the faceplate by blocking supported by the tailstock, while the weight is sustained by the chain from the overhead jib crane. There is nothing unusual in the method of holding, such work being probably done in approximately the same manner in all parts of the globe.

Using Ram to Drive Keys

Following the work of the sugar rolls through the shop, we come to the driving of the keys, in Fig. 4. This is not exactly the same method of holding as would be indicated by the planing of the keyway in Fig. 2. In this case a number of keys or wedges are driven in around the shaft so as to center the roll, the actual driving being done by substantial keys of the usual type.

It will be noticed that these keys are being driven by the time-honored method of using a heavy battering ram *A*, suspended by a block and fall while it is swung back and forth. The ropes fastened to the end of the ram show how it is pulled back by a number of helpers. The driving bar *B* is held in place on the shaft by the rope shown at the blocking, which holds it away from the shaft at each end, and at the same time directs it against the wedge to be driven. The roll rests on a pair of rollers *R*, which can be seen under the end, and is turned by the rope wrapped around the center of the roll in combination with the piece of timber stuck through a loop in the rope, and also bearing against the outside of the roll itself.

Back of this, behind the block and fall, is a large lathe with a gap bed, which is doing a repair job on the bowl for a centrifugal separator used in sugar-mill work. This is shown in a little more detail in Fig. 5, the size of the bowl and the lathe being indicated by the man who is nearly hidden by the post.

Turning with a Boring Tool Holder

Another interesting job is shown in Fig. 6, where the outside of a large pulley is being turned. This is too large to be swung over the carriage, so the tool block is swung at right angles and an extension tool holder or boring tool is used, which projects far enough to reach across the face of the pulley.

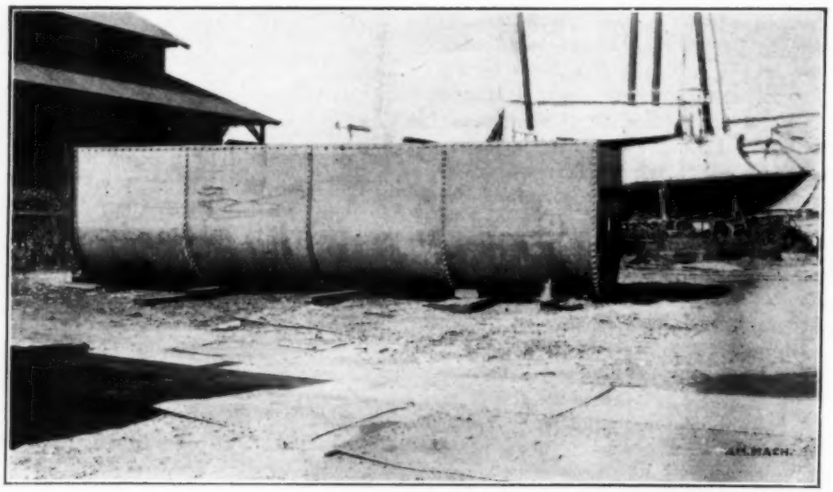


Fig. 1. Some of the Work Done

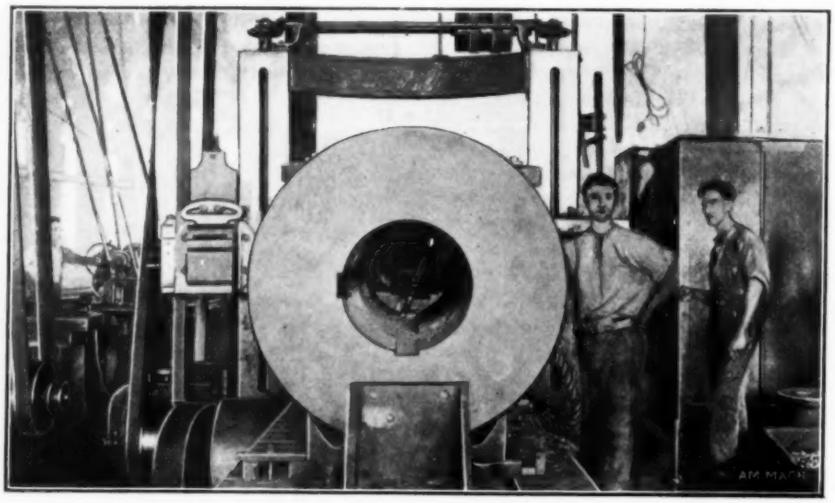


Fig. 2. Planing Keyway in Sugar Roll

A traveling-head shaper of unusual design is shown in Fig. 7. The ram is driven by the connecting rod *A*, which is pivoted to the arm *B*. A crankpin and block on the gear *C* play in a slot in the arm *B*, and impart motion to the ram. Varying the distance from the center of the gear to the crankpin gives the desired variation in stroke, while the positioning of the ram is accomplished by adjusting the end of the connecting rod as usual. Power is secured by a pinion on the shaft *D*, which meshes into gear *C*, and travels along the shaft *D* to accommodate the location of the shaper head with relation to the bed.

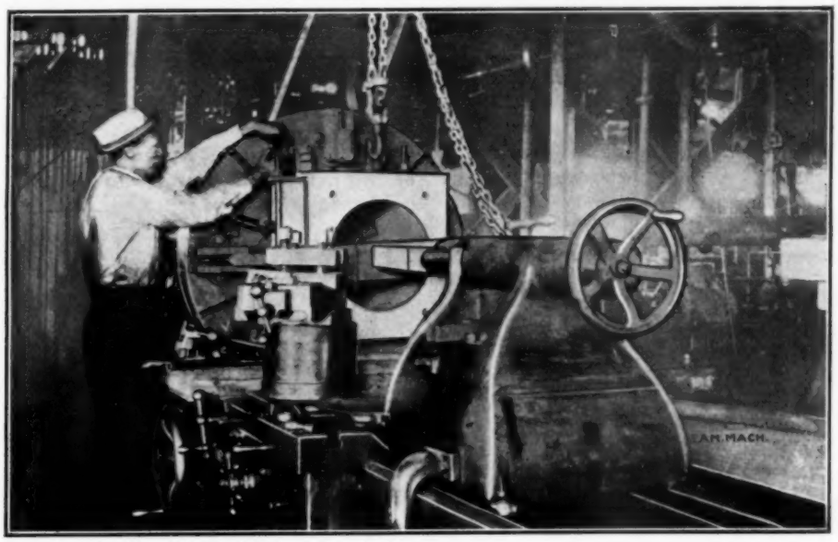


FIG. 3. BORING A BEARING FOR THE ROLL SHAFT

SOME TOOLROOM WORK

The toolroom is in charge of a very genial Cuban, and the only English-speaking man in the place is the assistant manager. He immediately pointed out the various interesting features in his department, and, considering the nature of the work which is handled in this shop, many commendable things are being accomplished.

Some idea of the work that drifts into the toolroom of a shop of this character may be seen in Fig. 8, where a comparatively large pinion is being cut on a rather small Cincinnati miller. The one shown is a steel pinion of 20 teeth, and approximately two-inch circular pitch. It was a heavy job for this machine, but it seemed to be handling it to good advantage.

Some classes of sugar-mill machinery use considerable comparatively small driving chain for power purposes. Some of this is being made in this toolroom on the nearest approach to a manufacturing basis found in any of the shops visited in this vicinity. These chains are of the roller type, and while being made with very simple tools, are practically interchangeable and are manufactured at a comparatively low cost.

Most of the work is done on the small vertical driller, shown in Fig. 9, which handles all the drilling and milling necessary. A short section of one of these chains is shown hanging from the feed lever and directly behind it one of the small sprockets, over which it runs. The links are cut from bar stock by a power hacksaw, and are then placed in the drilling jig *A*, so that the holes for the

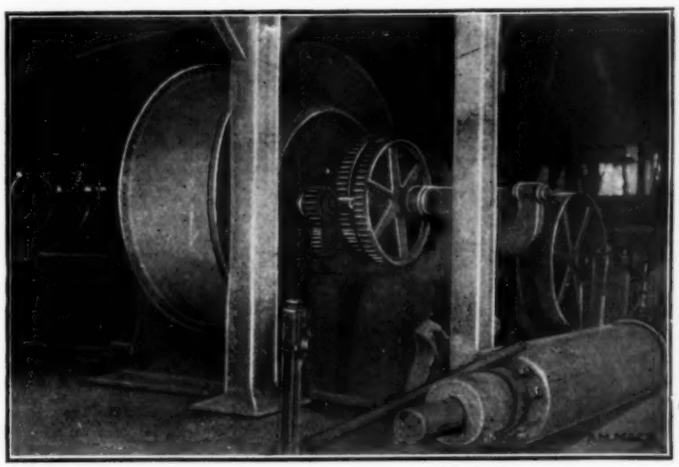


FIG. 5. BORING A LARGE SEPARATOR PAN

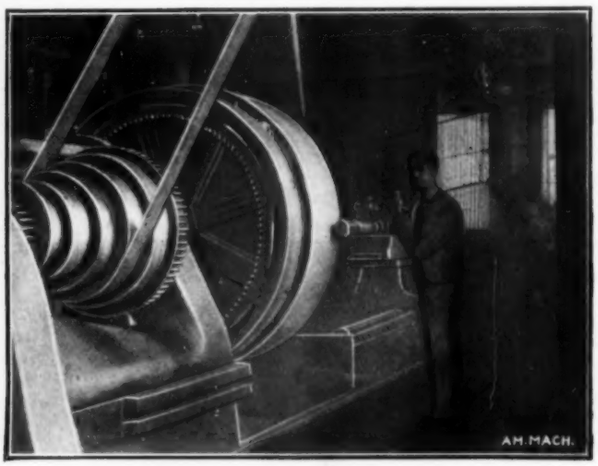


FIG. 6. TURNING THE RIM OF A LARGE PULLEY

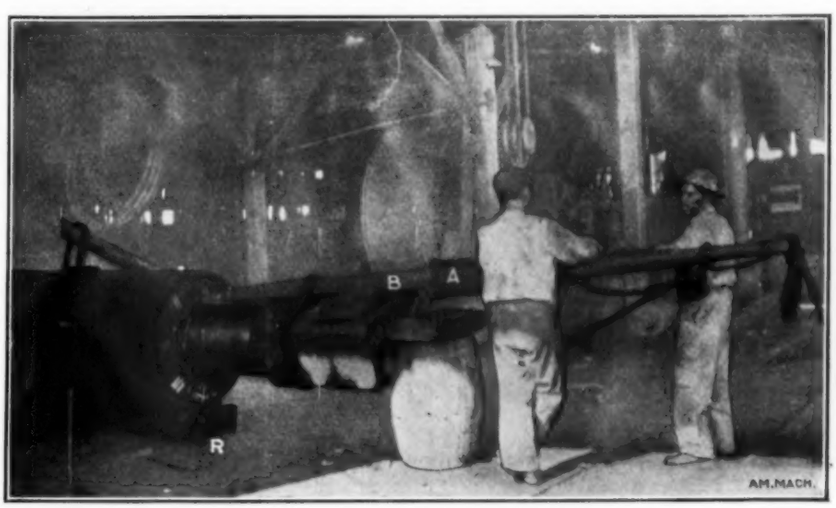


FIG. 4. DRIVING WEDGES WITH BATTERING RAM

pin will be uniformly spaced in all the links. The links are then placed in a holder *B*, and the hole in the other end slipped over a hard-steel pin in the block *C*, this block being fastened to the driller table so as to bring the end of the link to be rounded in the right position for the small milling cutter shown in the spindle. The length of this holding lever makes it easy to swing the link by hand around the hardened pin, and the ends are rounded as smoothly as necessary for this work. The link is then reversed and the other end milled in the same way.

The pin, rolls and cotters are all shown on the driller table, the ends of the pin being drilled for the cotters in a simple drilling jig, so that the whole chain is interchangeable and new parts can easily be supplied at any time. They are making many of their own small tools and parts, such as milling cutters, drill sockets and similar work, and taking great pride in their ability to do so.

This plant has recently been taken over by the well known Havana machinery dealers, Adolfo Horn & Co., to whom, as well as their assistant general manager, Nicolas Zayas, we are indebted for the illustrations and information secured.

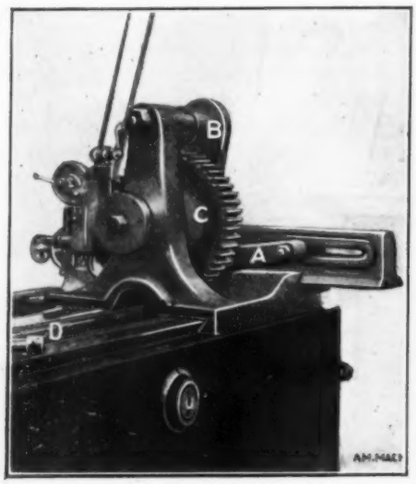


FIG. 7. TRAVELING HEAD OF OLD SHAPER

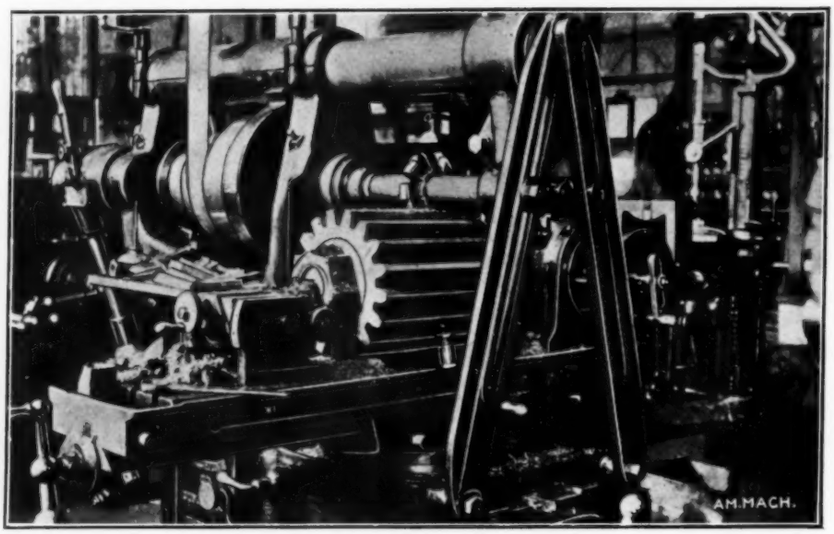


FIG. 8. CUTTING A LARGE PINION

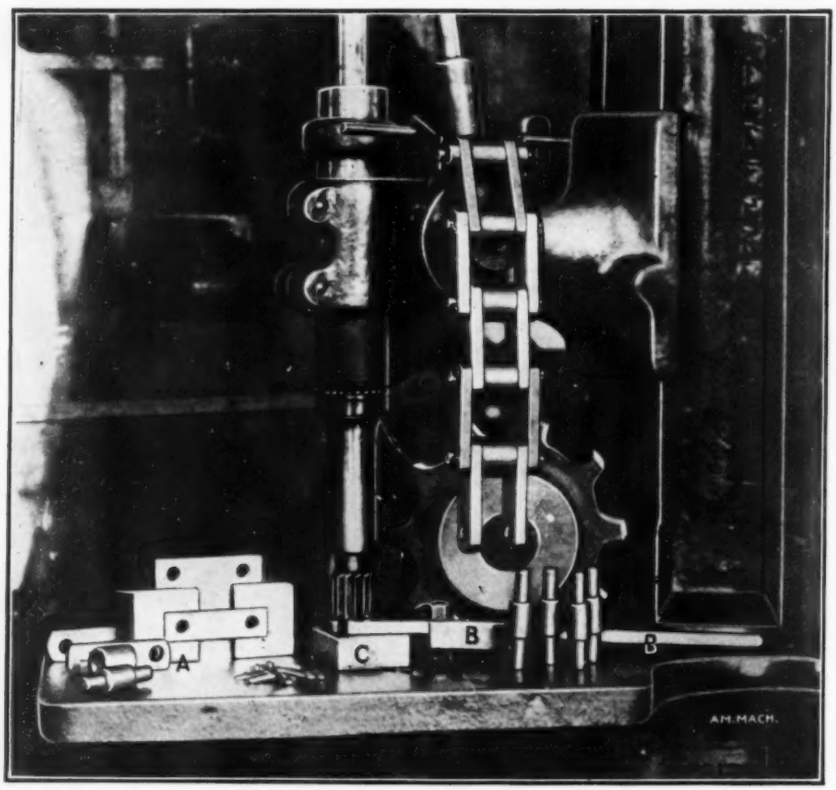


FIG. 9. TOOLS AND FIXTURES FOR MAKING ROLLER CHAIN

The Apprenticeship of Men as Opposed to That of Boys

BY ENTROPY

The No. 23, Vol. 35, issue of the AMERICAN MACHINIST was especially full of pointers that appeared to be valuable—from my point of view at least. C. A. Rogers struck a vein that always attracts my attention and especially so when, on page 1076, he expressed a preference for men as learners in the shop rather than boys. To tell the truth a boy is a confounded nuisance anyway. He really ought to be abolished, even if a constitutional amendment is necessary. Boys know nothing, they can be taught nothing, yet they are smart enough to dodge any grown man in the shop and add to his gray hairs in untold numbers. This seems to be a case for efficiency engineering. There is unquestionably a large amount of latent energy in every healthy boy, as can be observed whenever he begins to blow off steam. The direction of that energy into useful channels, without the expenditure of at least as much more energy, is something that has seldom been accomplished.

CONSERVING JUVENILE ENERGY

Tom Sawyer probably did as well with it as anybody, when he got his job of whitewashing the fence for an amount less than nothing to the tune of a dead rat and some other boyish treasures. There are records of other flimflam games by which boys have been persuaded to really work for greater or shorter periods, but after studying all the available records both in fiction and fact there appears to be no way of getting more than a 50 per cent. efficiency. This is had by the starvation process. By this method a boy is reduced to that stage of empti-

ness at which he is willing to do anything desperate for the sake of a slice of bread. He is also in a state where he is physically incapable of doing more than half his maximum work. When he is sufficiently resuscitated to work at full efficiency again he rediscovers that he is full of the Old Nick and you have to wait till he is starved again before you get any more work.

There are, of course, a few boys like what we all were, whose only thought is to make the most of their opportunities and become deacons in the church. They number possibly 1 per cent. of the total, though that may be stretching it some. But the difficulty is, Mr. Rogers, that the other 99 are with us and must be raised. When we were young the 99 simply did not last to grow up. Bad sanitation, overwork, underfeeding and improper food took care of them and the law of the survival of the fittest left the rest of us who were too tough, physically, to get killed off.

Now what are we going to do with these undesirables? They simply will not stay in school until they graduate from high school as Mr. Rogers suggests. Their parents cannot, and will not, support them in comparative idleness until they are 21, before they choose a vocation. If they did it would be the worst possible thing for them because by that time they would have gained such an appetite for play that they never could acquire an appetite for work.

Delaying the Choice of Vocation

On the other hand Mr. Rogers is exactly right in his belief that comparatively few boys steady down enough to make a serious selection of a lifework until it is too late; that is the boy does not seriously consider it until he strikes the point where he has got to have money to satisfy some ambition. By that time he is usually started in some line of work for which he is not at all fitted by nature, and then we look at him and say; "Poor fellow, what he needs is an appetite for work."

What he needs is not the appetite. He needs work that is appetizing. When we were boys our fathers made us clean up our plates in the first course till there was nothing left but the large bones, well polished, before we had dessert. Most of our aversion to really healthful foods comes from this practice. Now we send for the family physician and he tells us that Johnny's digestive system craves and needs certain food values, etc., and we go off and scare up those food values and blame it on the high cost of living but we save the boy. That is we save his life, but his mechanical soul we seem to have lost, and we probably will continue to realize that it is lost until we take the bother to make work sufficiently attractive to make him take to it as naturally as he does to the more strenuous efforts of the playground.

Opportunity for the Young Man

Of course as a social problem somebody must really do something to entertain the boy from 14 to 21, whom Mr. Rogers evidently disdains. Then he strikes a very vital thing and that is that there is serious need of opportunity for the young man who feels the need of wages, and yet also feels that he is not filling his pay envelope as he ought. As things stand this is one of the most serious problems of the day. We are sorry that these boys are in this condition, but we realize that as another social problem we will have to do something for the misfit and for the untrained, and still allow them to earn a living.

Stripped of all advertising it seems possible to pick out certain isolated elements of knowledge directly related to most skilled trades, which can be taught in a rule-of-thumb manner. This is continuation schooling as now practiced. It has the look of a royal road to learning, but it has nothing but the look. A man who has memorized the formula for the horsepower of a steam engine

$$Hp. = \frac{2\,PLAN}{33{,}000}$$

may yet be in doubt whether he should apply it to a single- or double-acting engine, and how it should be applied to a compound engine; whereas if he knew the principles he could apply it to anything. If it were not for the endeavor to make a quick showing he would be taught principles and how to apply them to actual cases rather than learn actual cases with hardly a mention of principles.

Discussing the variance of opinion between boyhood and manhood as to the choice of work, it seems to me that Mr. Rogers ought to go a step further and call attention to the varying opinions which men hold from day to day. How many men are there who are satisfied with their work, how many who have settled ideas of what they wished they had done, and how many of the friends of the latter could tell them much better what they ought to have done? The root of which simmers down to this: That a man is no better qualified to judge what he ought to do for a living than he is to conduct his own law case before a court, and that is—not at all.

I believe that we are going to see some great things done in the way of steering boys into vocations in the near future. We will undoubtedly see some large mistakes made at first but we shall see results that justify the mistakes, particularly as they cannot be greater than those usually made by the present lack of system.

A Future for the Skilled Mechanic

The editorial on the same subject on page 1091 sounds a warning that cannot be too often repeated; that is that industrial schools are, by nature, climbers, and that they will, unless held close to the ground, climb to the level of fourth-rate technical schools. Even today among some of the younger schools there is a tendency to say that the schools are not for the mere workmen, but for the bosses and foremen of the future and that the workmen of the future will be merely operatives who need nothing except a few hours training in performing a single operation.

This attitude may be right but it seems to me that it is entirely likely that the future holds out greater rewards to the skilled mechanic without executive ability. We are certainly only at the beginning of an era of skilled workmanship in this country. The demand for close, accurate and difficult work is decidedly on the increase.

Educational Status of the Schools

As for looking for trade-school results that will justify the existence of trade schools at this early day, it is absurd. There are practically no trade schools in the country. There are about 100 schools that pose an industrial schools but of this number you can only count about a dozen which have any serious idea of training for a trade. The rest merely give training with a "vocational content" or are "preparatory" to an apprenticeship, etc. The dozen are all working along differing lines and are really experiment stations from which there may some day be graduated a few boys more or less well fitted for some trade.

Of course, every one of these schools believes that it is on the right road, and possibly there are many parallel roads all leading to the same goal, but until these roads begin to converge, and some definite scheme seems to demand general adoption we cannot expect that there will be enough graduates from trade schools to produce any effect on the industries. For quick returns the continuation school is the only visible hope, and while personally I do not think that it builds its work on a deep enough foundation to be of its greatest value, we certainly owe the boys and men who have already gone into industries without proper training, whatever can be done to ameliorate their condition.

The Price of Labor

Prof. Schneider follows out the same line of thought in his article on the natural law of work. It may appear cynical to say that men work because they must, rather than as a duty toward themselves and others, but I fear that we must face that conclusion. There are some men and firms that buy labor as they buy coal, so much money for so much work, and the laborer can go hang the rest of the time. Then again there

are other firms which have some of the milk of human kindness and who carry their employees through hard times and take pride in doing so. There is also the hypocrite who pays for his labor in hopes that can never be realized, with a small cash allowance each week to keep body and soul together.

Each of these types takes the ground that this method produces the highest efficiency, that is, it gives the greatest returns per dollar of outlay. The man who keeps his help employed through hard times claims that by so doing he retains his best men and that they work better as a matter of gratitude. The man who drops his employees when he has no work, says that he keeps his men paid the best and gives them a chance to pick up other employment during dull times. The man who pays in hopes says that that is what he lives on and consequently it should be good enough for others.

In handling the other side of this question, or in questioning the wisdom of the "let-well-enough-alone" policy that is so prevalent the world over Professor Schneider is likely to carry the crowd with him. Even the most hardened employer cannot but admit the truth of all that he has to say, but it is easy to say that one accepts a belief, and so hard to back that belief with one's pocketbook. On the other hand it certainly seems to the disinterested outsider that an employer cannot afford to hire men who are not in a cheerful, healthy frame of mind, inasmuch as no man can afford to work when he is not cheerful and healthy.

The hardest time for a man to decide what he should do for a living is when someone—his wife or his interested friends—begins to urge upon him his duty to them and the world, in some designated line of work for which he feels himself unfitted, because of the fear that his income may thereby be diminished. The one thing that a man cannot afford to do is to consider tomorrow's wage in deciding what he will do. A man who is contented can live on less money than a man who is not, and he can in the end get all the money there is in the job for him. On the other hand if the employers who pay labor in terms of hopes could realize the diminished returns that come from men whose hopes have been shattered, but who hang on hoping against hope, they would quit the practice in disgust.

Cutting Rack Teeth on the Planer

By W. S. Leonard

In a shop where long racks are not cut often enough to justify the purchase of a milling attachment for the planer or a rack attachment for the miller, they may be cut on the planer by providing a simple indexing dial for the cross-feed screw.

The dial used is shown in Fig. 1, secured to the cross-feed screw in the end opposite the feed gear. The construction of the dial hub *A* will differ somewhat on different planers, but when the screw is of the design shown, the flanged casting bored to fit over the collar *B* of the screw and over the square end will answer the purpose. The dial proper *C*, may be clamped in any position around the hub by the lock bolt *D*.

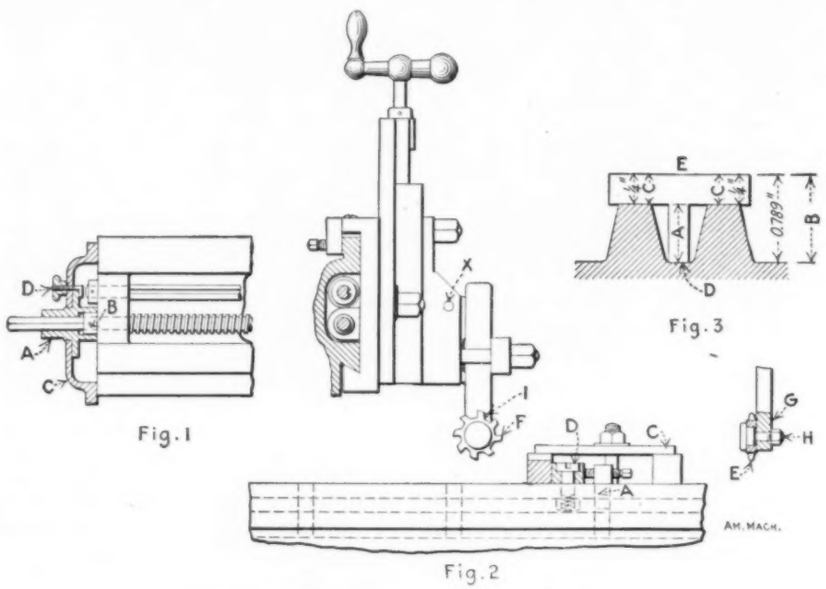
If the cross-feed screw is, say ¼-inch lead, the dial may be about nine inches in diameter and graduated with 500 divisions around its periphery *E*. This will provide for reading to 0.0005 inch, as 0.25 inch ÷ 500 = 0.0005. As the lines would be $9 \times \frac{3.1416}{500} = 0.0565$ inch apart, we could measure 0.00025 by estimation, but the average planer screw is not reliable enough for such accurate spacing.

Of course, to get good results, care must be taken to guard against looseness or backlash in the screw and a half-box, made of hardwood and held by a wedge in the channel of the cross rail, so as to give light pressure against the screw will correct the looseness. The backlash or end play of the screw in its nut and in the bearings, may be taken care of by tightening the cross-rail gib screws so that the head moves stiffly. Then, if while turning the screw to move the crosshead the pitch distance, it should happen to be moved too far, it must be turned back more than sufficient to take up the backlash and turned forward again until the dial indicates the stopping point. In other words, the backlash must be kept in the same direction for each tooth space cut.

After cutting each space, instead of loosening the bolt which locks the dial and turning the latter back to zero, it is just as well to take the last position of the dial as a new zero point and count from it, the stopping line being distinguished by covering it with a touch of red lead and marking through the lead with a scriber.

Theoretically, that is, neglecting the error in the screw, circular pitches, such as ¼ or ½ inch, may be spaced exactly, and diametral pitches may be spaced with practical accuracy in connection with the dial.

In actual cutting, the first thing to be done, taking a four-pitch rack for example, is to scribe a depth line the full length of the rack blank, which, according to the Brown & Sharpe system, is 0.539 inch. Next bolt a flat parallel bar across the planer table, fastening to the T-slots with filister-head screws, as shown at *D*, Fig. 2. This is used as a stop for the rack and should be thin enough to allow the cutting tool to clear it. The rack is now strapped down as indicated; a roughing tool about 0.01 inch narrower than the narrowest part of the tooth and with slightly rounded corners, is put in the tool post and the job is ready to start.



Cutting Rack Teeth in the Planer

With this tool in the tool post, cut the first space down to within about 0.01 inch of the scribed line and make a mark on the feed-screw collar to feed to on the subsequent cuts, then run the tool up; feed the head along three turns and 71 divisions and rough out the next space and so on till all are cut.

After the spaces have all been roughed out, put a 4-pitch milling cutter in the tool post, as shown in Fig. 2, and finish to exact dimensions by planing the first slot to correct depth by using a depth gage, as shown in Fig. 3, then marking the feed-screw collar and proceeding as in the roughing operation.

Purchasing by Competitive Bids

By Henry Williams*

Application of efficiency-management to the purchase of supplies. Inviting competitive bids on accurate specifications of the material wanted results in better quality and lower prices. Drafting such specifications.

*Naval constructor, U. S. N.

Efficiency engineers have concentrated their energies largely in an effort to systematize the manual-labor operations of manufacturing, and thus have endeavored to increase the output for the labor expenditures. It is a fact generally conceded that it is possible in this way to effect a very considerable saving, and the adoption of scientific methods in the direction and application of manual labor justly has become popular and widespread.

There does not seem to exist a like attitude as to the possibilities offered in pursuing similar methods regarding the materials used in manufacturing operations, in fact, there has been little discussion of this important feature in the costs of production. Its importance may be judged by a consideration of the final cost of any manufactured article, the material charges being often equal to, and in many cases greater than, the labor charges. Often considerable effort is required to produce a reduction in labor cost of manufacturing some articles, when equal, if not greater, saving could be made without difficulty through the use of cheaper materials, or by reducing their purchase price.

The average firm is content to leave its purchase to a purchasing agent, and his methods are frequently the result of caprice. Current literature contains many accounts of methods of salesmanship which, when analyzed, all resolve themselves into skillful flattery of the purchaser. Materials are bought from the same firm from habit, or if a change is to be made, trial orders are placed on the basis of obtaining satisfactory results before payment is made. These decisions as to results are then left to the foreman or workman, who may or may not have been "seen," and whose judgment at the best is capricious and rarely based on the real requirements of the case.

Inviting Competitive Bids

Often orders are placed through considerations of personal or business friendship, or because the seller is financially interested in the buyer's company. Rarely is careful examination made of the exact requirements for the material needed, and more rarely still are these shaped into accurate specifications, bids invited and the contract awarded without favor to the lowest bidder offering material of the quality desired. On the other hand, many corporations do make their purchases after full and free competitive bids have been obtained. The railroads, numbers of large manufacturing concerns and the various government, state and municipal departments have such systems in use. All of these, however, vary considerably in details as to effectiveness, methods pursued, etc.

The Navy Department is probably the largest purchaser under such a system, and is a pioneer in these matters. More advanced methods of purchasing materials under specifications are in vogue in the naval service than in many of the large corporations, which boast of complete systems of scientific management of labor operations.

There are, of course, minor exceptions to the rule, but it may be stated in general that the bulk of the Navy's purchases, which often have exceeded $50,000,000 for one year, and which range from a complete warship to a gross of pens, are made from the lowest bidders in duly advertised competitive bidding, without favor or preference.

Drafting Specifications for Bidders

It will be easily seen that the first necessity in any such system of purchase is that there should be available specifications covering in detail the requirements for each class of supplies purchased. Such specifications should mention the essential requirements and the tests that will be imposed on the material to determine its conformity with the specifications. While the Navy Department cannot boast of a complete set of standard specifications for all materials used, it has many such, covering the bulk of the articles generally purchased, and is adding continually other specifications to its list.

The most elaborate specifications under which purchases are made naturally are those covering a complete warship. These are embodied in volumes, often having more than 500 pages, and are accompanied by numerous contract plans. They are so complete that little choice is left to the builder as to the materials to be used in construction, the details of the ship or the quality of workmanship. Under this method of purchase, the United States not only has secured warships of the very best quality of design and workmanship at considerably less cost than other powers, but has enabled the builders, by forcing them to adopt economical methods, to underbid foreign builders bidding for the contracts.

The Purchase System in the Navy

As it is apparent that the main and essential requirement of any such competitive purchase system is the availability of proper specifications covering the articles to be purchased, a description of the Navy's system of specifications is given. Aside from the purchase of new ships, public works, special machinery or plant, the specifications for which are drawn to fit the particular case in question, the bulk of the regular stores and materials are covered by standard leaflet specifications, which are generally referred to in all proposals for bids for stores or materials.

There is a total number of about 800 of these specifications, a list and index of which is published quarterly by the Navy Department. Each specification is published separately, and thus is subject to revision or reissue at any time without effecting the others. For the purpose of designating any particular specification, an ingenious system of numbering has been adopted. For storekeeping and accounting purposes, naval stores and materials are divided into 64 main classes, or divisions. Each leaflet specification is assigned a designation consisting of a number showing the class to which the article covered belongs, an initial designating the article and a serial number differentiating between articles of the same class and initial. Thus, "Class 52" includes painting materials and varnishes. The specification for orange-shellac gum is "52-S-1," for white-shellac gum is "52-S-2," for white zinc, "52-Z-1."

One of the most important classes of specifications is that for hardware, which covers all kind of locks, hinges, bolts, hooks, etc. The principal requirements in each case are that the workmanship of the delivery must conform to standard sample, that the material and weight must be as specified and that the size and position of screw holes and shape must conform to sketch given in each case in the specification. Thus, any piece of hardware bought under one of these specifications is interchangeable with another bought under the same specification. The importance of this is evident. For example, if a door hinge or a hook is broken beyond repair, one can be secured at once from stock to replace it without refitting. Under these specifications considerable competition for the hardware contracts is obtained and the prices are much lower than was the case when special makes had to be specified, while the quality has not depreciated.

Similar general requirements exist as to plumbing materials, and although the specifications are not in such detail as to render interchangeable all fixtures received, at least the type, characteristics and workmanship are specified in such detail as to provide free competition on an equal basis.

All the provisions for the Navy are purchased under specifications of the sort described, and, owing to the rigorous conditions to which they are subjected, through being stored on shipboard in all climates, the food provided for the enlisted men on board ship must be of the highest quality. In spite of this the cost to the government is less than 40c. a day for each man, a figure that few restaurants could meet and still provide the same quality of food.

Competitive Buying Lowers Prices

Many instances can be cited to justify the statement regarding lower prices in competitive purchases under specifications. A notable case of this is the purchase of high-speed tool steel, which is bought in large quantities for all navy yards, and especially so for the gun factory at Washington, where 50-ton orders are common. Formerly this was secured on proprietary requisition, which mentioned a particular brand, the price ranging above 55c. Specifications were adopted and competition secured both in price and quality, and the same firms reduced their bids as much as 15c. per lb., the net result being that a little better quality of high-speed tool steel is secured now at a very considerable saving.

Another instance of this kind is the purchase of varnishes, which, for many years, were ordered from specified firms. Specifications were adopted whereby bids are invited, each bidder being required to submit samples. Examination of these samples is made and the contract is awarded to the lowest bidder whose sample is found to contain no impurities and only high-grade materials. This method has resulted in obtaining a better grade of varnish at a reduction in price, in many cases approaching one-half that formerly paid.

Some of the Risks Encountered

The purchase under specifications are subject, however, to some risks, the most important and the one most difficult to guard against being the tendency to specify qualities in the materials that are not essential to the uses to which they are to be put. A notable example of this was the Navy's experience in the purchase of gum shellac, about 500,000 lb. of which is purchased annually, mainly for use in making a shellac varnish, colored with venetian red, for application to the linoleum-covered decks of the warships. Formerly the specifications for gum shellac mentioned several of the best brands in the market, and required that not more than 1 per cent. should remain insoluble in hot alcohol. This specification required and secured the highest-grade shellac in the market, at a cost of 5[illegible]c. per lb.

Consideration showed that the color and the low amount of insoluble matter were both of no importance in the manufacture of shellac varnish for decks, due to the admixture of venetian red, which is darker than the shellac and insoluble in alcohol. Experiments showed that the varnish made from the high-grade shellac had no advantage in wearing qualities over that made from low-grade shellac. It was concluded, therefore, to draft the specifications to cover the low-grade shellac gum. As a result the price paid for gum shellac has ranged about 20c. per lb. This represents a saving of many thousand dollars.

Another similar case was the purchase of white zinc of the grade known as "French white zinc." This differs from the grade known as "American white zinc" only in whiteness. The purposes for which white zinc is used on naval vessels either involve mixing with a darker pigment or else use in locations where extreme whiteness is of no importance. Consideration quickly brought about the decision to buy only the American zinc, at a saving of about 1¼c. per lb. on an annual purchase of about 800,000 pounds.

Accurate Specifications Necessary

Another advantage in purchasing material by specifications is the knowledge derived by the trade as to the usual requirements for such materials. It occurs frequently that articles are offered which have characteristics adding no value for the purposes intended, though the manufacturer may have gone to considerable expense to obtain them.

As has been seen, to take full advantage of any competitive purchase system accurate specifications are necessary. It does not suffice to obtain prices from several dealers on arbitrary selected grades of materials, for the lowest bidder may be figuring on entirely different characteristics from the others, and thus his price, though nominally lower, might be actually the highest.

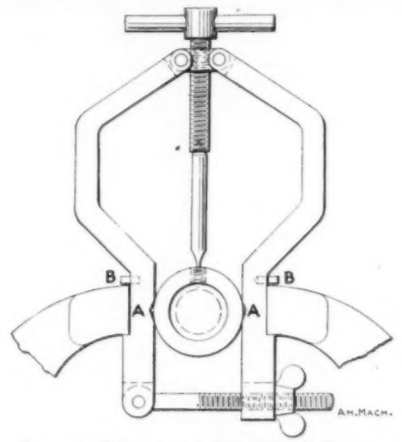
The conditions of delivery and inspection should be specified clearly, as well as the terms under which rejections will be made. How quantities are to be ascertained is important, as there are certain trade customs which may complicate matters considerably. For example, linseed oil is sold generally on a basis of 7½ lb. to the gallon, though a full gallon weighs over 7¾ lb. Where full gallons are contemplated, it is desirable to mention the fact especially in the order. Also for certain classes of paints the weight billed sometimes includes the weight of the package. It is desirable, therefore, to specify that net weight only be billed.

Jig for Handling Stubborn Screws

By James Wylie

Much time and trouble are often spent in handling stubborn screws. What is wanted is a device for holding the screwdriver in the slot of the screw. The diagram shows a device I designed for extracting stubborn screws in sockets, machine tap holders, etc.

The frame is ¾x1¾ in., slightly V'd at *A*, thus holding the arbors in a direct line with the screwdriver. The block on the top is ¾x1⅛x2 in., drilled and



Jig for Handling Stubborn Screw

tapped to receive a screw ⅝ in. diameter, 16 threads, 3 in. long. This screw is counterbored at one end at an angle of 60 deg. to receive a screwdriver ½ in. square and 3 in. long, turned at one end at an angle of 60 deg. Square steel is preferred for a screwdriver, as it can be easily manipulated with a small wrench.

Two pins projecting at *B* allow the device to rest on the vise jaws while gripping the work in the vise.

This device is not confined to use in the vise, as will be noticed by the dotted lines at the bottom. It can be applied to any diameter of spindle, by making the lower end with a swing bolt and thumb nut. If required, the device can be used at right angles in the vise jaws, by changing the position of the pins *B*.

To use, insert the screwdriver in the slot of the screw, then by turning the handle on the top, bring down the screw to the conical point of the screwdriver, thus holding the screwdriver firmly in the slot. When turning the screwdriver with a wrench, turn the handle on the top sufficiently to relieve the pressure, so as to allow the screw to come out.

The difficulties which have always been encountered in utilizing peat for fuel are due to the fact that in its natural state the material contains only about 10 per cent. of combustible matter, the remaining 90 per cent., more or less, being water; this water is inherent because of its nature.

Dies for Patent Fasteners

By Wilhelm Müller

German follow-up dies for forming small brass parts complete at each stroke of the press.

The continual rise in wages and increased competition have led, in the sheet-metal working lines, to better and cheaper methods of production. This is especially true in the manufacture of the patent fasteners with inserted wire springs, used on gloves, pocket books, and the like. While only a few years ago many of the various operations required in this work were in part performed by hand in Germany, of late the industry has gone further and further to automatic processes.

A and *B*, Fig. 1, show the upper and lower parts of a wire-spring fastener, or push button, the two parts requiring for their manufacture entirely different machines and tools. These parts are now made from long rolled brass strips from 0.003 to 0.010 inch thick, according to the size of the fastener made. The width of the strip depends upon the diameter of the button and the number of them to be stamped out at once. Usually three or five are cut out at a time and it is not advisable to exceed the latter number on account of the difficulty in making the tools.

The steps in the production of the upper part are shown in Fig. 2 and consist of drawing (three operations); forming the neck (two operations); embossing or lettering; piercing the pin holes and

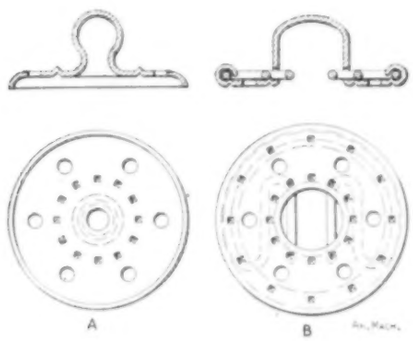


FIG. 1. THE TWO PARTS OF THE FASTENER

punching the formed piece out of the strip, the last punch also dishing the edge.

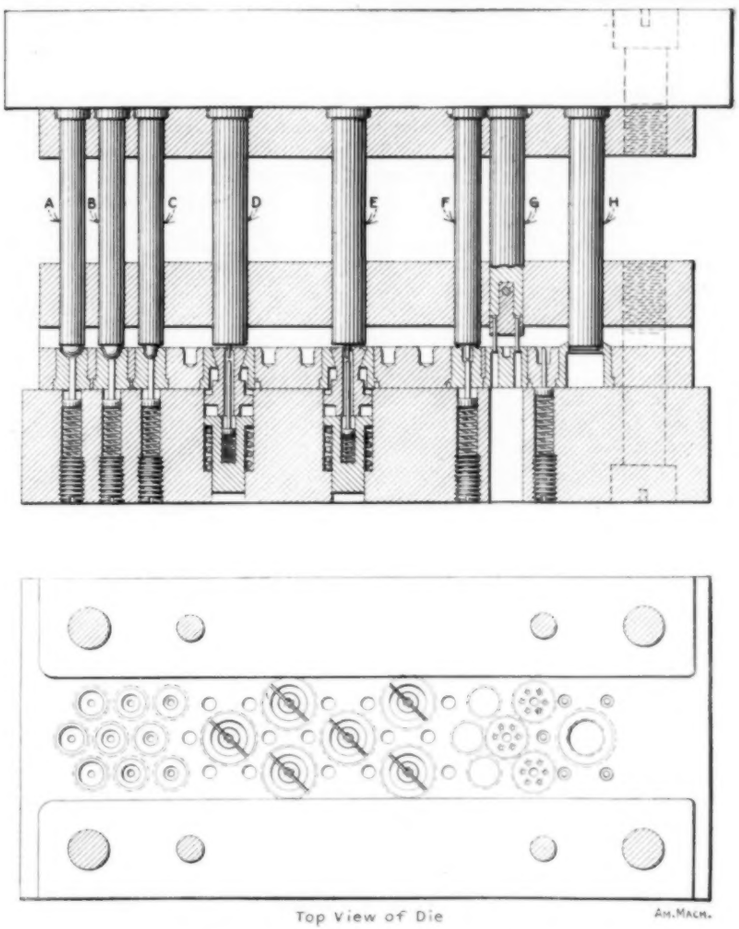


FIG. 3. DETAILS OF FASTENER, TOP FORMING DIE

DETAILS OF THE DIE

Fig. 3 shows the die used for the above example, which, while finishing three at each stroke of the press, may be designed to finish five at a time, as previously suggested, where the work will admit of it. In this cut, *A*, *B* and *C* are drawing punches; *D* and *E* for contracting the neck; *F* for embossing; *G* for piercing the pin holes, and *H* the punch

FIG. 2. GRAPHIC VIEW OF TOP FORMING PROCESS

for cutting the finished piece from the strip, the edge being dished at the same time, as previously stated.

It will be observed that ejectors are used to prevent sticking, as would be the case since automatic feed is used. The skipping of spaces in laying out the die was to allow for the change in length of the metal during the forming and is more plainly shown in the top view of the die in the lower part of the cut.

Forming the Necks

A little study of the cuts will make all the workings of the die perfectly plain, except the neck forming, which is done by *D* and *E*. This contracting of the neck is done by conical jaws which come together like the jaws of a pair of pincers. Normally these jaws are pressed upward by springs and are open far enough to admit the knob, but as the punch descends they close in, the first set pressing the neck in somewhat oval, but the next set with its jaws set at right angles to the other, finishes it round.

The Output

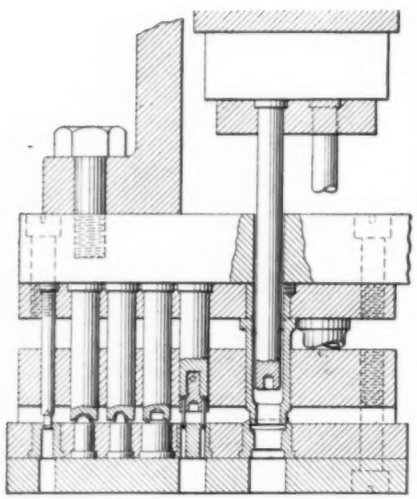
With this die, using a press built by L. Schuler, Goppingen, Germany, running at 80 strokes per minute, we get a daily production of $3 \times 80 \times 60 \times 10$, or 144,000 pieces in a ten-hour day, not allowing for stops or breakdowns.

The press used has a feeding device operated by a clamp key, and not by a ratchet and pawl, which makes it easy to adjust the feed for any spacing without trouble.

Forming the Lower Part

The lower part of the fastener is

Fig. 4. Steps in Forming Bottoms



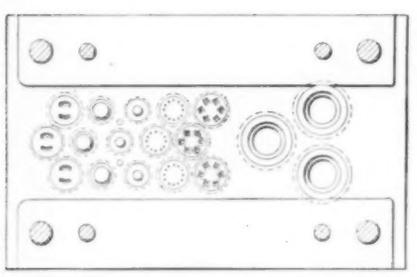


Fig. 5. Details of Dies for Bottoms

stamped out, as in Fig. 4, the slots for the spring being punched as shown. These slots were formerly milled out with two small mills set into a special head.

Fig. 5 shows the die used, which is very similar to the one just described, except that it has no neck-forming device, the work being but plain piercing and drawing, in regular steps.

The press used for these bottoms is made by the same firm as the one used for tops and runs at the same speed, so the output is the same in either case.

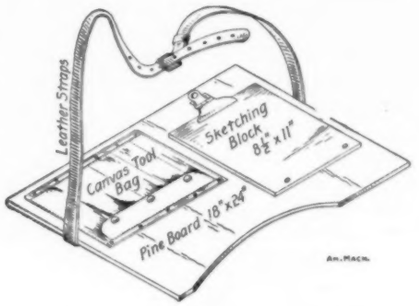
Owing to the speed at which these presses run, the punches and dies are kept cool by a continuous stream of soap water.

The springs used in the bottoms, are commonly inserted by hand and the edge of the piece turned over to hold the spring in, in small Schuler presses fitted with the familiar turret or disk feed, and running about 60 strokes a minute. These presses have two punches, the first one turning the edge inward and the second curling it down.

A Convenient Sketching Device

By R. B. Dale

The accompanying diagram illustrates a convenient sketching device. It consists of a small drawing board about 18x24 in. It is intended that when the board is in use it will be hung from the shoulders of the draftsman. For this purpose leather shoulder straps are attached on each side at a point a little beyond the center. When the device is not in use it may be allowed to hang vertically from the shoulders and the user is but little inconvenienced in moving or climbing about. The straps are adjust-



A Convenient Sketching Device

able as to length. The side of the board nearest the user is cut away slightly to conform to the natural form of the body.

The board is provided on the right with a sketching block or pad, which is securely held by means of a spring clip. Two small pegs at the lower end fit into corresponding holes in the block to prevent it from slipping about. It is intended that the sketches when completed may be removed from the block and inserted in a loose-leaf book cover.

On the left side the board is provided with a canvas tool bag which is fastened to the board by means of thin metal strips at each end. The canvas flap may be fastened down by means of straps and buckles or snap fasteners as desired. The bag is divided into compartments in which the draftsman may keep his tools. One compartment is intended to receive a steel scale and a folding pocket rule. The second compartment will take inside calipers and dividers. The third will take outside calipers. The fourth will take a 5-ft. and a 50-ft. tape, machinist's square and protractor, pencils, erasers and other miscellaneous equipment. It is thus seen that provision is made for the storage of a complete sketching equipment

When taking measurements the board may be laid to one side if necessary in order that the draftsman may move freely about. A sheet of celluloid may be kept under the hand to protect the sketch from dust and grease.

Truing an Oilstone

By E T. O'Brien

The following is not very well known among the trade. Everyone knows that truing up an oilstone by rubbing it on a plate covered with emery is a long and tedious job. It is a very easy matter to put the stone in a shaper vise, and with a black diamond as a shaper tool, take fine cuts, thus truing it in a very short time.

Manufacturing Small Taps and Dies

By Chas. A. Diller

Does it pay the average manufacturer to produce his own taps, dies, reamers, etc?

A concern that is an exception to the general failure in this respect, and the methods it employs.

Various articles have appeared in the AMERICAN MACHINIST at different times discussing the question whether or not it pays to make small tools, such as taps, dies, reamers, etc., in the shop, or to purchase them from manufacturers.

In a shop manufacturing adding machines, typewriters or other light machinery on the interchangeable basis, an immense number of small taps and dies is required in the course of a year. Many firms are consequently led to attempt the manufacture of their own, and the majority fail, because of the fact that the manufacturers can sell them for less than they can be made for at home.

One conspicuous exception to this general rule is a large typewriter firm, employing about 1000 men. This concern has been making its own taps and dies for years, at a cost far below that for which they can be purchased, and with better results as to the high quality required in work of this character.

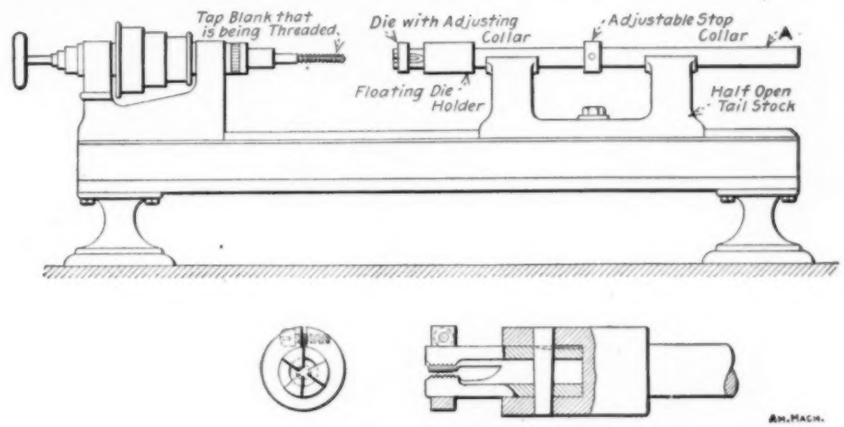

Tap Blank that is being Threaded.
Die with Adjusting Collar
Adjustable Stop Collar
A
Floating Die Holder
Half Open Tail Stock
Enlarged View Showing Die, Section of Clamp-ring and Part Section of Floating Die
AM. MACH.

FIG. 1. THREADING TAPS AND DIES IN BENCH LATHE

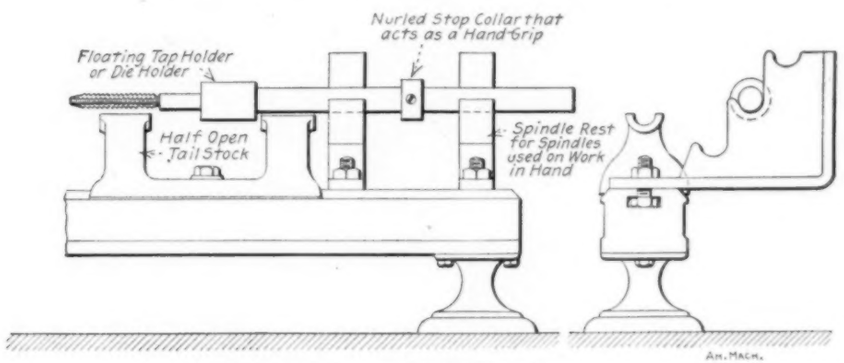

Nurled Stop Collar that acts as a Hand-Grip
Floating Tap Holder or Die Holder
Half Open Tail Stock
Spindle Rest for Spindles used on Work in Hand
AM. MACH.

FIG. 2. HOLDING FOR TAPPING SPINDLE

METHODS EMPLOYED IN MANUFACTURE

The following illustrations show the methods employed, and include data relative to one of the sizes used, 0.058x72. The screws produced are of sharp V-thread, slightly flattened on top, for ease in manufacture. All manufacturing taps are cut with master dies as follows:

The tap blanks are first turned and pointed 60 deg. in a turret lathe fitted with a very true running chuck, and are then transferred to a chuck in a bench lathe, having a half-open tailstock, allowing any number of dies to be used on one tap. The bench lathe, Fig. 1, is shown set up for threading, with the tap to be threaded in the chuck and the half-open tailstock in position on the bed. *A* is a spindle carrying the threading die, and is held in position on the tailstock by the hand. With this method, any number of dies can be used on a tap, each die mounted on a separate spindle. These spindles should be placed on a rack attached to the back of the lathe, as shown by Fig. 2, which allows a change to be made from one to another without loss of time.

The best feature of the hand-held die holder, used on the half-open tailstock in the manner shown, is the ease with which the thread can be caught on the second and third passes of the die, a sensitiveness of feel being brought into play, which would be absent in a wholly machine-operated die holder.

Master taps, which are turned and threaded with a regular thread tool in the lathe in the usual manner, are used for cutting the master dies spoken of above, that is, the dies for cutting manufacturing taps.

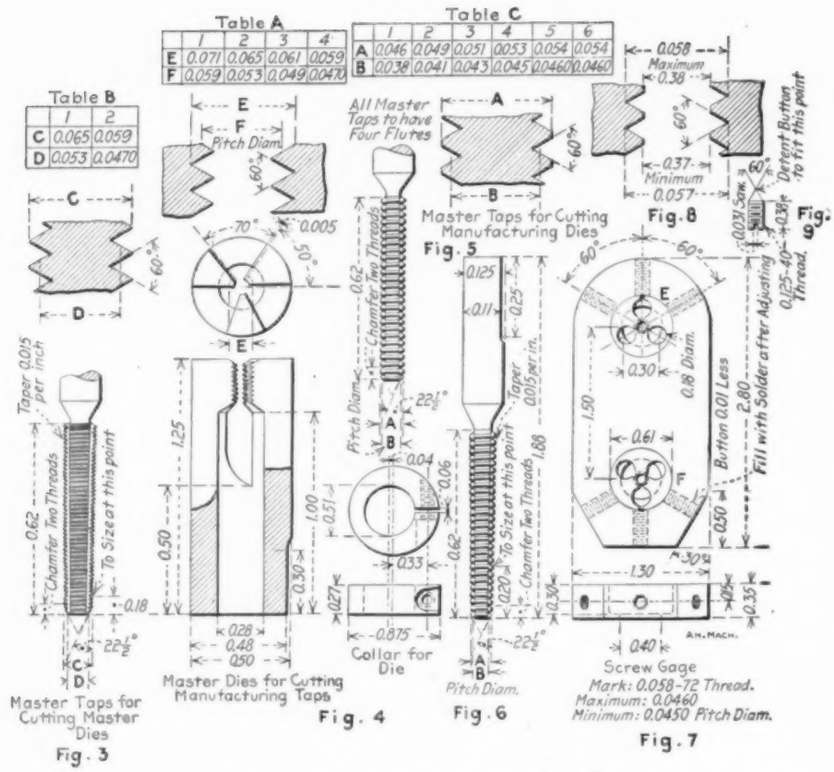
Two master taps, shown in Fig. 3, are used on each of a set of four master dies, Fig. 4. The master taps are tapered, thus giving the dies back relief, and by running the taps in to the correct depth in each of the four dies, a difference of diameter is produced, as can readily be seen by Table *A*; Table *B* corresponding to the master-tap diameters.

CUTTING MANUFACTURING DIES

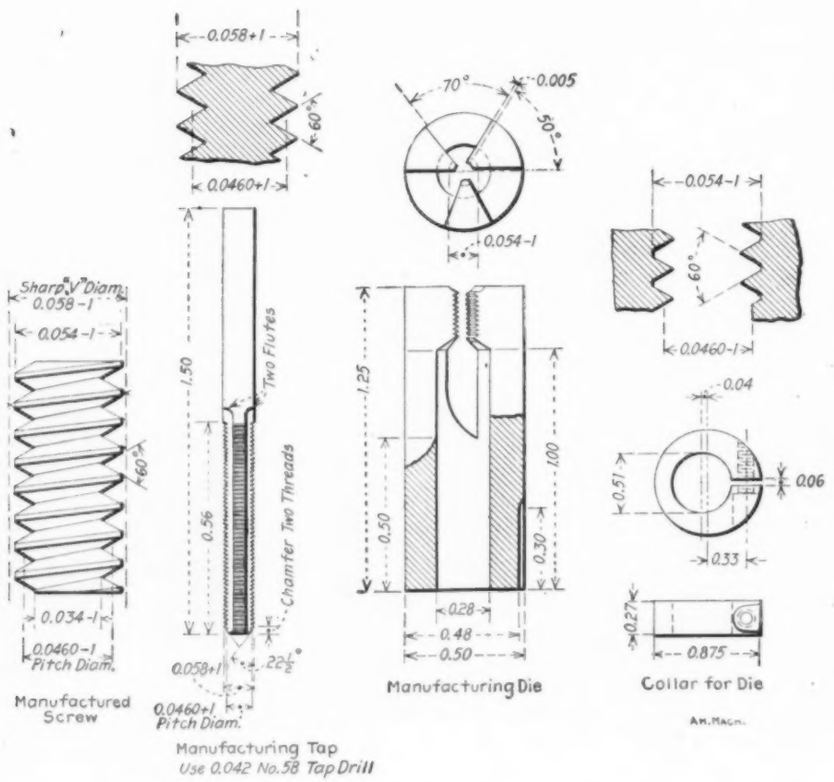
For cutting manufacturing dies, methods quite similar to those used for cutting manufacturing taps are used, only the die is held in a special chuck, and is threaded from the rear. The master tap is held in a floating holder in the half-open tailstock spindle, in the manner before described. Six taps are used, each removing a few thousandths more than the preceding one, except No. 6, the finisher, which is made taper to give clearance to the die. Table *C* and Figs. 5 and 6 show the proportions of the taps. The form of the master dies for cutting the manufacturing taps is shown in Fig. 4; this view also shows the adjusting collar for the die.

GAGING DIAMETER OF SCREWS

For testing the screws being manufactured, the form of gage shown at Fig. 7 is used, which admits of gaging the maximum and minimum diameters, as can readily be seen from the detail, Fig. 8, showing the setting of gaging points *E* and *F*, Fig. 7. After the gage is set correctly by adjusting detent screw, Fig. 9, the slots of the screws are filled with solder, this effectually preventing tampering with the gage and at the same time permitting of easy adjustment when necessary. The manufacturing die produces a screw to conform to the measurements given in Fig. 10. Here the limits are —0.001, while the limits on the manufacturing tap, Fig. 11, are +0.001.



DETAILS OF MASTER TAP, DIES AND GAGES



FIGS. 10, 11, 12 AND 13. THE MANUFACTURING DIE AND TAP, AND THE SCREW PRODUCED

Thus the tap, when at its minimum diameter, is as large as the screw at its maximum diameter, which insures the work going together. Fig. 12 gives the proportions for the manufacturing dies and Fig. 13 shows the collar for the dies.

Worm and Gear as the Ultimate Drive Applied to Heavy Power Vehicles*

BY RALPH H. ROSENBERG†

Consideration of several features impelled me to a single conclusion, viz., that the worm gear is the most logical means of reduction, especially for truck construction. With the conviction that this was the correct principle, I determined to embody it in the design of a solid-tired car, employing a ratio of seven-to-one. Having acquired all the obtainable data, I regarded the task of application quite an ordinary matter.

A worm and gear were made and tested with unsatisfactory results; others were substituted, procured from makers specializing in work of this character. The results were the same. The magnitude of the problem dawning upon me, I determined to find a solution, if possible. The termination of various attempts in failure was fully discussed with friends who essayed to discourage any further efforts. I therefore decided to maintain a strict silence regarding my experiments until I developed a successful design.

I immediately started a series of experiments for the purpose of eliminating the doubtful factors. This comprised a systematic testing of various metals, diameter of gears, shape and size of teeth, location and kind of bearings. Special care was exercised to obtain accurate results, which were recorded. I summarized my conclusions as follows:

SUMMARY OF CONCLUSIONS

Material: For worm, semi-hard steel, fine texture ground and polished; bronze gear burnished; floating worm support; rigid wheel support; thrust bearing back of annular bearings; straight side shapes of tooth. Several gears constructed in accordance with these data showed improvement in running efficiency, but, the starting efficiency was low, due to improper lead angle.

The most serious trouble was stripping the bronze gear teeth. It was, therefore, imperative to find an alloy capable of sustaining excessive pressure. In 1907, I succeeded in producing a metal possessing these qualities; employing a high-grade phosphor bronze and adding a certain percentage of magnesium, the results were marvelous. A gear of this material showed double the strength of the metal

*Excerpts from a paper presented before the Society of Automobile Engineers.

†Mechanical engineer, Kinnear Mfg. Co., Columbus, Ohio.

previously used. It is susceptible to such a degree of hardening that it is exceedingly difficult to file, permitting the taking of a high polish, and therefore requiring less lubrication. The maker of the metal will guarantee a tensile strength from 105,000 to 110,000 lb. per square inch.

This troublesome obstacle surmounted, my attention was directed to the various phases of pitch and lead angles in tooth formation, as they are prime factors determining the starting efficiency. Ratios, lead and tooth angles were continuously modified, until satisfactory conclusions were reached, establishing a formula giving uniform results for ratios over five-to-one.

My contention is—and I have proved it empirically—that, first, the tooth angle and angle of lead or advance must coincide, and, second, that the advance angle fixes the diameter of the worm. It is determined by extending the lines describing the flanks of the teeth to points where the intervening distance is equal to the lineal pitch times the number of leads; the distance from these points to the pitch circle of the gear is the diameter of the worm.

I have adopted the following method for determining the width of the gear and face of the teeth. They are described by diverging lines from the center of the worm, including an angle of 120 degrees. Gears made according to this formula will permit a reasonable amount of variation between the pitch circle of the worm and the pitch circle of the gear, the surfaces remaining complementary. This is not permissible with any other form and allows a certain latitude in manufacture. It is absolutely necessary, however, to maintain proper relation of the axes.

Cost

I have heard it asserted by those conceding the utility and desirability of the worm gear that it was an expensive device. My endeavors to ascertain upon what grounds this assumption was made and what particular items entered into the consideration of cost were usually met by general statements. So I conclude that the cost-of-manufacture information, while not as vague as that relative to designing, is, nevertheless, indefinite. I take the liberty of quoting from E. R. Whitney's paper of June, 1911, relative to the cost of worm-gear construction, wherein he states the worm-gear drive is not a cheap device, and that the indicated efficiency and durability results cannot be expected unless the gears are properly designed, constructed of the best materials and accurately mounted on high-grade anti-friction bearings.

I concede this statement to cover the essential facts generally, but on the question of cost take issue, believing the worm gear to be the cheapest form of final drive. It is admittedly true that proper design is essential to the success of any mechanism, but it does not follow that proper design will entail any expense over and above improper design, so far as it relates to the cost of manufacture. In my experience I have found that the materials used in the worm and gear are not more expensive than those employed in the bevel-gear drive or the side-chain drive, where double reductions are used. Furthermore, a distinction should be made between experimental work and work of actual production where the facilities are provided for executing large quantities. In substantiation of my statement I give the following data, taken from records covering the cost of producing a worm and gear for a 5-ton truck:

Bronze ring gear blank	$18
Steel for worm	$9
Time machine worm	2 hours
Labor on worm, rough turning	2 hours
Milling	2 hours
Grinding	3 hours
Ring, gear turning	3 hours
Cutting	1 hour and 10 minutes

The parts were then in condition for assembling.

Concerning the durability of the worm gear, I am in accord with Mr. Whitney, and can say that I have inspected gears after they have run 120,000 miles and found them in excellent condition. Granting that the expense of production is higher, it is offset by the greater life of the gear.

Building a Large Planer

The Detrick & Harvey Machine Co., Baltimore, Md., is building a large convertible planer, the word convertible meaning that the planer may be used as an open-side planer, or by using an auxiliary post, as an ordinary type of planer. The main post of this planer is 18 ft. high and 8 ft. wide. Some idea of its size may be obtained by referring to Fig. 1, where it is shown in contrast with a post from one of the firm's small open-side planers, the size of the small post shown being 7 ft. high by 3½ ft. wide, the two posts being familiarly known in the shop as "Jeff and Mutt."

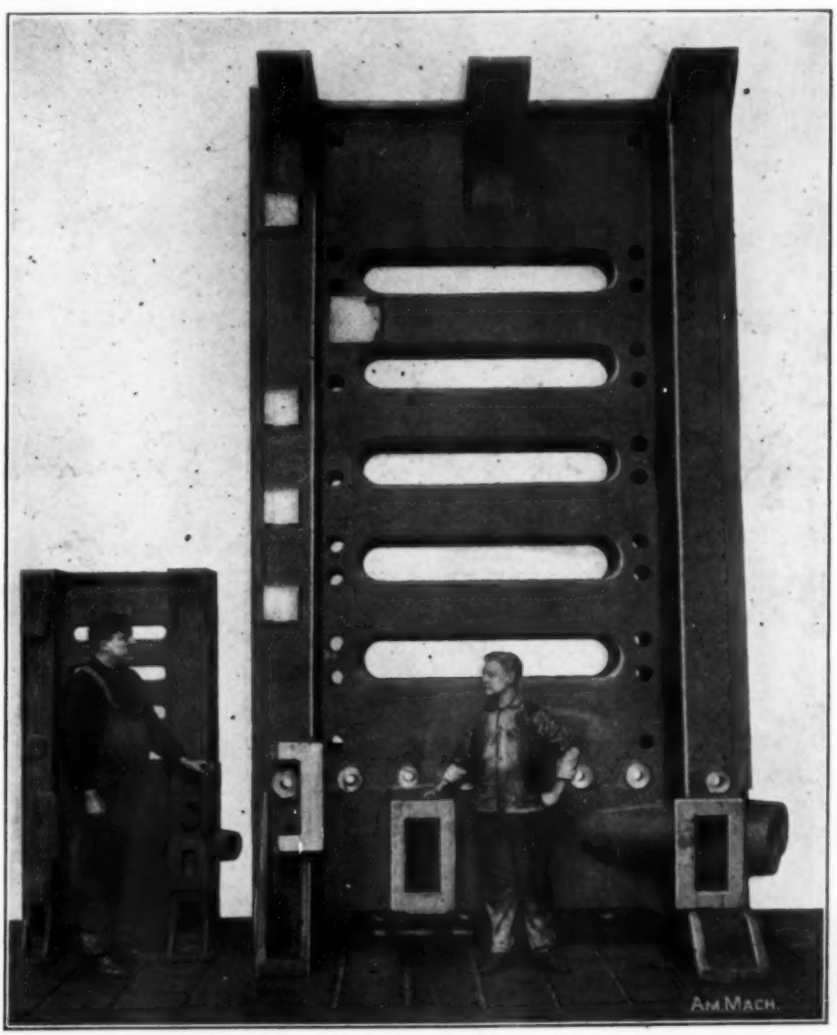


Fig. 1. "Jeff and Mutt"

The table of the big planer is 7½x20 ft. and the planing capacity is 10x20x8 ft. in height. The bed is made in two sections bolted together; one of the bed sections with the 18-ft. post in place is shown in Fig. 2.

One of the principal features of this new planer, outside of its great size, is that the table is to be operated by a double Sellers' drive, the holes for the wormshaft bearings being shown at *A* and *B*, the latter having the boring bar in place. The boring bar is operated by a machine, shown in Fig. 3, built especially for this job.

The borer is clamped and bolted to the same floor plate on which the planer bed is fastened. The boring bar, which is 3⅛ in. by 28 ft., is automatically fed along by the machine, which is in reality a self-contained, motor-driven, horizontal borer with a 5-in. spindle.

The longest single distance bored by the bar is 4 ft. and in order to steady the heavy bar an auxiliary bearing *A* is used close to the cut.

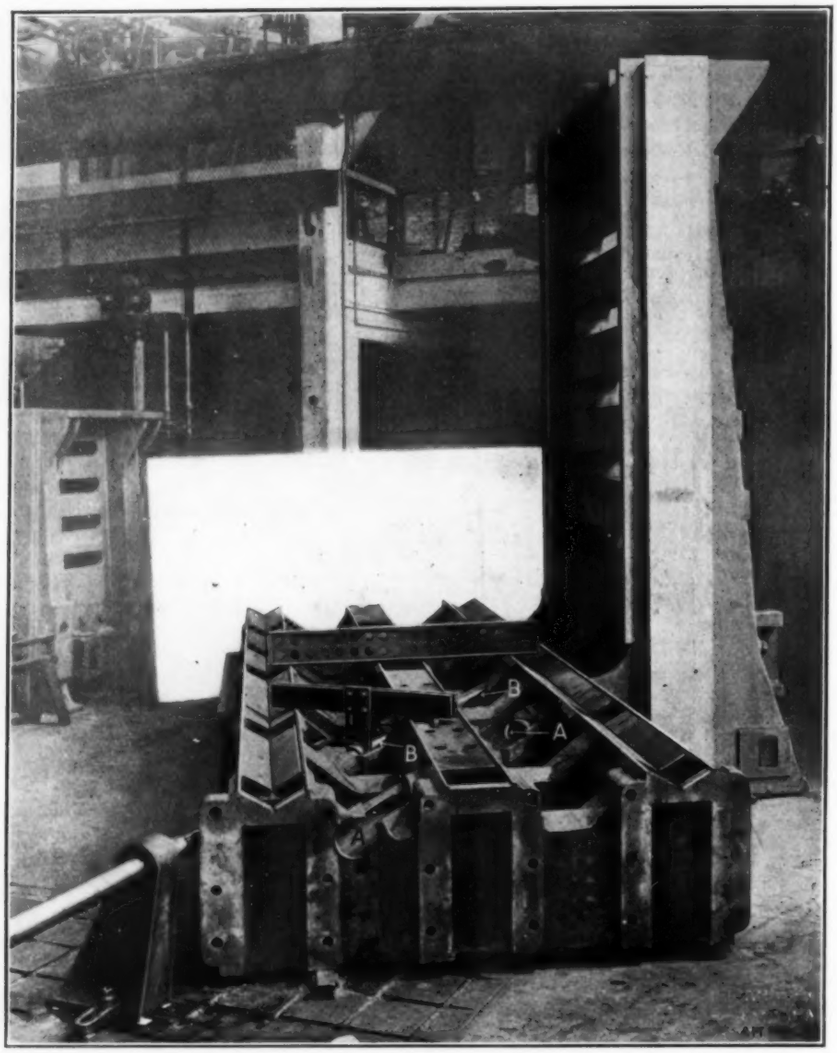


FIG. 2. HALF OF BED WITH POST IN POSITION

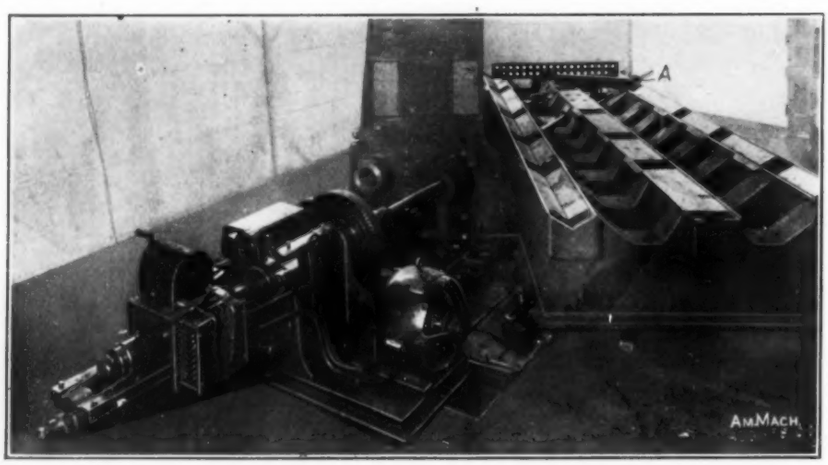
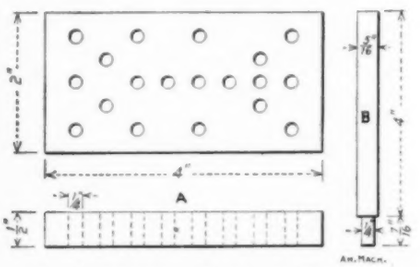


FIG. 3. SPECIAL MACHINE USED FOR BORING OUT WORM-SHAFT HOLES

A Convenient Drilling Fixture for Irregular Pieces

BY GEORGE WILLS

This device consists of a base *A* of flat finished steel, in which are drilled many holes, and three steel pins *B* of equal length, having one end turned down to fit the holes in the base.



A CONVENIENT DRILLING FIXTURE

The pins may be inserted in any of the holes in the base to suit the work to be drilled. The work rests on the three pins, and the drill breaks through between them.

This device is very convenient for drilling irregular pieces of work that will not lie even on the driller table, but which have enough even surface to rest on the three pins. It is most useful, however, when drilling two or more pieces of work which are held together with screw clamps, especially where the holes are to be drilled very close to the clamps. The work rests on the pins, keeping the clamps clear of the driller table. A set of pins 6 in. long may also be used where the work requires it.

An ingot of cast manganese steel is as brittle as glass, but when reheated to a temperature of 1000° C. or more and suddenly chilled by plunging in water, it becomes as ductile as soft carbon steel or wrought iron, and has three times their tensile strength. Manganese steel cannot be forged except with great difficulty and as no method is known for softening it, cannot, to all practical purposes, be machined. Objects of manganese steel are, therefore, cast, reheated and chilled.

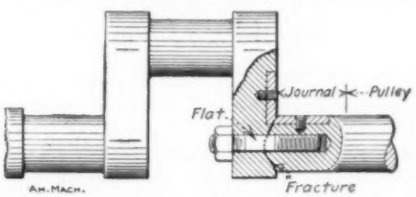
Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

A Crank Repair in the Backwoods

A repair to an engine of the semi-portable type, used to run a lumber plant miles from anywhere (as regards repairing facilities), was recently accomplished by us in a very ingenious manner.

The two crankshafts fractured at the crank web nearest the flywheel, completely disabling the engine and thereby putting the whole plant out of business. Chemical welding might have made a job of it, could we have waited a week for materials and supplies, but as time was



AN INGENIOUS CRANK REPAIR

pressing, our engineer undertook to make a repair that would hold until a new shaft could be procured.

A 1½-, a ½- and two ⅜-in. taps were discovered in the toolbox, which, with an inch drill, hammer, ratchet, chisel, file and a few wrenches, also a spare main-bearing stud of 1¼-in. size, formed the stock in trade of the repair store. The inch drill was drawn out to 1⅛-in. clearance size and a hole bored through the web, which was marked off as nearly central as possible; then the drill was redressed down to 1⅛-in. tapping size and a hole bored in the shaft to coincide with the one in the web. This hole was tapped to take the main-bearing stud we found.

Two flats were cut on the stud to enable us to screw it up tight with a wrench, which we did, leaving a sufficient length to pass through the hole in the web and take a nut. As the engine ran from right to left, or contra-clockwise direction, the stud would have slackened back when running. To prevent this, an L-shaped key was forged and keyways cut in the web and shaft to take the L-key. The inch drill was again dressed and drawn down to half-inch tapping size, and two holes bored through the key into the web and shaft; these holes were tapped half-inch, and two pieces were cut off a valve-stem gland stud and screwed through the key into the web and shaft.

These studs were riveted over and the whole thing filed up flush, as the horizontal leg of the key was in the bearing and had to be a part of the shaft's perimeter. The nut inside the web was then screwed up hard and the end of the stud riveted up to insure it keeping tight; $\frac{1}{16}$ in. had to be filed off the crankpin brasses to allow them to clear the nut inside the webs. The engine was then coupled up to run at 200 r.p.m. for some time under this repair until the new shaft came forward. When the repaired shaft was taken out there seemed to be some service still in it.

The diagram may give an understanding of the ingenuity displayed by the engineer in charge and the labor entailed with the appliances at hand, the whole thing being accomplished under 18 hours.

C. F. MACDONALD.

Dundee, Scotland.

Forming Heavy Brass Tubing

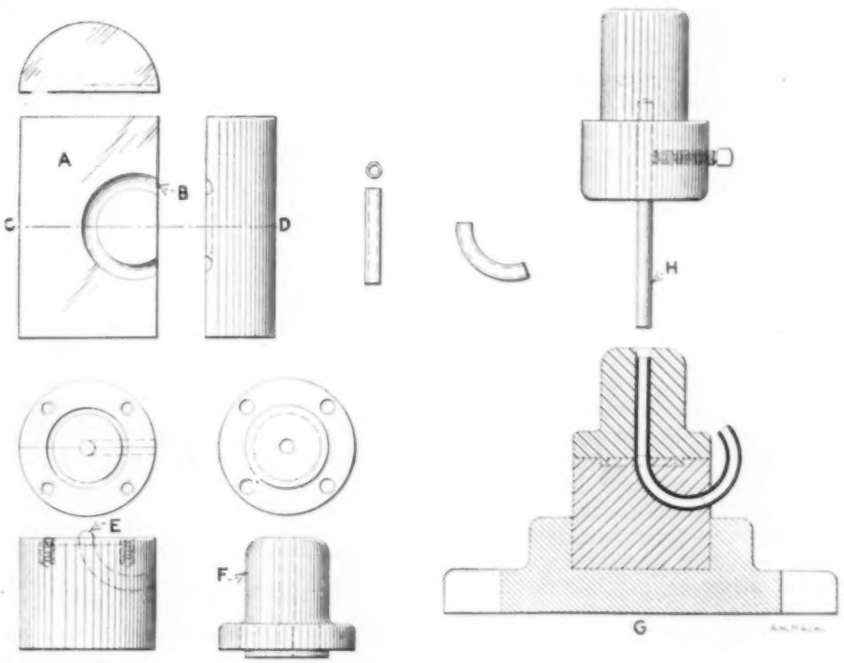
A forming die to shape brazed brass tubing without distorting or splitting, is shown in the accompanying diagram. The regular grooved bending die was first tried and given up as useless, as it split 60 per cent. of the tubes and flattened the ends; then a die was made as shown.

The piece *A* is of round tool steel 2½ in. in diameter, 4 in. long, planed half way, then put in a lathe chuck, faced true and a groove *B* cut in it ⅛ in. radius and ⅛ in. deep. The piece is next sawed in two on the line *C D* and the two halves clamped together with the groove filled with ¼-in. steel balls. It is next turned up to fit the base and the bottom faced off, then while held in the base with setscrews it is strapped to a faceplate, trued up with an indicator from the steel ball *E* projecting out of the groove, and the top faced and counterbored to fit the tongue of the guide bushing *F*.

The Guide Bushing

This is made of tool steel, hardened and lapped to a good fit for the tubing, and is bolted to the die with four capscrews. A sectional view of the assembled parts with three tubes in the process of passing through the circular groove, is shown at *G*. At *H* is the straight punch which forces the tubes through the die. In operation, it descends within $\frac{1}{32}$ in. of the top of the curved hole of the die. This die formed 30,000 pieces of brazed tubing without splitting one.

Monmouth, Ill. FRED TIBBETH.



FORMING HEAVY BRASS TUBING

Renewing Lathe Spindle Bearings

The bearings and spindle of a "Star" lathe having got into bad shape and out of line, it was decided to turn the spindle necks up and line the brasses with babbitt. The headstock was taken apart, the spindle trued up and the brasses bored out and drilled to hold the babbitt. The top halves had been reduced about ⅛ in. at the joint, so four small pegs were fitted to bring the outside of the brasses to correct size. See Fig. 1. This was done before the boring. The inside was then tinned. Next, a bush was fitted to the threaded ring, which takes the thrust in this lathe, to act as a bearing for a boring bar, to which a handle was fixed for revolving the bar.

This is shown in Fig. 2; also how the other end of the bar was supported and the manner of feeding. A box was set to turn the bar, while the lathe hand held back the bar with one hand on the carriage feed crank and fed the bar through by means of the tailstock screw. The boring was done in less than an hour, and the bearings only required to be scraped to fit the spindle, and the headstock assembled for the job to be complete.

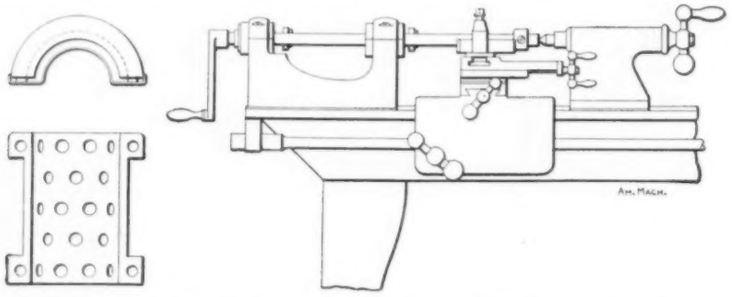


FIG. 1 RENEWING LATHE-SPINDLE BEARINGS FIG. 2

For running the bearings up with babbitt metal, two sheet-steel formers were made. These were tied to the bearings and placed end up, with clay pressed all round and a runner formed at the top. The lot was then heated and the metal poured. When taken apart, the metal was found to be very firmly held to the brasses. The lathe was tested for alignment and passed as quite satisfactory. It has now been in use over a year without the bearings being adjusted, and apparently will not need it for some time.

We formerly had a lot of trouble this way, and the spindle was always badly scored. With babbitt metal the scoring has quite ceased and the lathe runs more smoothly. There seems to be a widespread prejudice against the use of babbitt metal for lathe-spindle bearings. If a suitable quality of metal is used, it is a great advantage, reducing the friction considerably, as compared with bronze, and requiring much less adjustment.

J. J. SHAW.

Derbyshire, England.

Drop Forging Catalogs

I wish to suggest that it might be to the advantage of manufacturers of drop forgings to distribute catalogs showing at the top of each page a sketch with finished-size dimensions thereon of their various available dies for forming gear blanks. On the same page there should be a list of prices for forgings made from the above in lots of 100, 500 and 1000. Prices should be given for machine steel of about 25 to 30 carbon; 3½ per cent. nickel machine steel of the same carbon; for nickel vanadium alloy, and also for chrome nickel vanadium alloy steels.

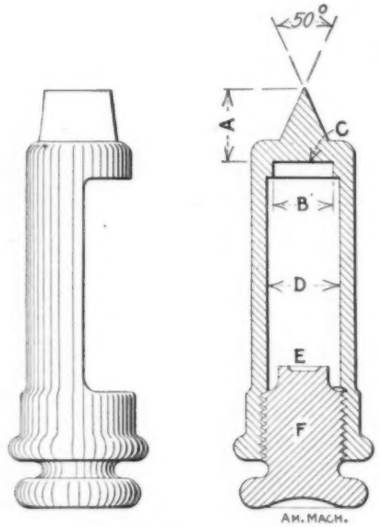
The same idea carried out on postal cards which could be mailed at intervals, would keep up the interest of customers.

S. A. SMITH.

Asst. Supt. Meisel Press & Mfg. Co.
Boston, Mass.

A Micrometer Attachment

Here is an attachment I made for my micrometer for measuring the bottom diameters of male-thread gages and taps. I found it exceedingly useful in a shop not overstocked with tools, but where they generally rigidly enforced a tolerance of



A MICROMETER ATTACHMENT

+0.003 in. in female threads up to about ½ in. diameter and +0.005 in. up to 1½ in. diameter.

I do not give dimensions, as micrometers vary both in length and diameter on the anvils and ends, and it is particular that it should be a good fit on the anvil and not too long in the body to be unsightly and out of proportion.

I made mine 0.250 in. in length at *A*, on which I left 0.002 in. to come off after hardening; *A* in water and the rest of the body and pin *F* in oil. After hardening, I cleaned the side faces of *A* and removed what was left by rounding the sharp edge. The diameter *B* should be a good fit around the anvil, but not too tight, or it will not be easy to get it to bed down properly on the face *C*.

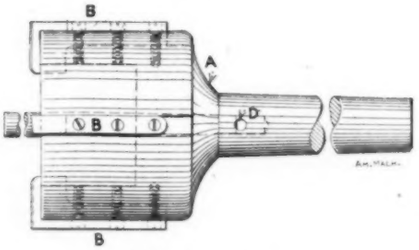
Diameter *D* should clear the micrometer entirely, the attachment only being located and held by *B*, *C* and *E*, the face of the latter being hollowed out to clear any projection there may be on the micrometer. The pin *F* should be threaded with a fine thread and made a good fit. I found $\frac{5}{16}$ in. diameter by 26 threads very satisfactory.

Birmingham, Eng. E. WRIGHT.

A Hollow Mill

The diagram shows an inserted-tooth hollow mill I designed.

Cutters from 1¾ to 2⅜ in. in diameter can safely be used, which allows its use for different diameters. This mill has been in use for six months, and I have



A HOLLOW MILL

not had to replace a cutter yet. The cutters are milled in a gang. The mill has been used with great success on steam metal and hard brass.

The machine-steel holder *A* has four slots milled in it for the cutters *B*. These cutters are made of tool steel. A taper hole in the holder allows different sizes of pilots to be used, if desired. *D* is a hole drilled in the holder to drive the pilot out.

Baltimore, Md. EDWIN D. SHOOP.

The question of whether or not to use a lubricant or coolant in cutting cast iron crops up from time to time. The prevailing idea seems to be that the iron glazes so that the tool tends to slide over it, but some use lubricant to advantage. We would be glad to have readers tell us just what their own experience has been and what lubricant they are using, if any. Also the kind of work they are using it on.

Discussion of Previous Question

Referring to letters and articles previously published

Making the new Cincinnati Coarse Pitch Milling Cutters

The milling cutters with coarse teeth, recently developed by the Cincinnati Milling Machine Co., and described on p. 753, Vol. 35, have different tooth angles from those of the regular line of milling cutters, and require a special set of cutters to produce them. Table 1 gives the dimensions for a set of cutters to properly machine these coarse-pitch teeth. The table gives a list of the cutters employed for this purpose at the Blake & Knowles Steam Pump Works.

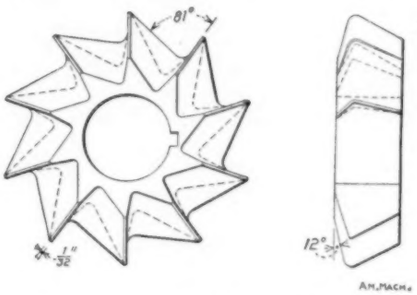


FIG. 1. THE NEW TYPE OF CUTTER

While it is not always economical for a manufacturing concern to compete with the regular cutter manufacturers in making new cutters, the recutting of old milling cutters is a profitable thing for most concerns. We have adopted the practice of recutting our worn-out milling cutters to the dimensions as given in Mr. De Leeuw's paper, "Milling Cutters and Their Efficiency" in the *Journal* of the American Society of Mechanical Engineers, and reprinted in the AMERICAN MACHINIST," p. 753, Vol. 35.

By recutting old-style cutters to the new Cincinnati type, it will be seen that the cost of repairing milling cutters is considerably reduced by their conversion to new-style cutters. The old cutters in use in most manufacturing plants represent a considerable investment. Owners and managers hesitate about discarding them for new styles; but recutting of existing cutters can assist in the rapid introduction of the new type of cutters for such work as they are adapted to.

Dimensions of Cutters for Milling New Cincinnati Cutter Teeth

	No.	Degrees	A	B	C	D	E	F	G	H	Used for Making
	1	50	50	1	3	3/8	3/8	1/4	5/16	End Teeth in 1¼, 1½ and 2 inch Solid End Mills
	2	55	55	1	3	7/16	7/16	3/32	5/16	End Teeth in 1 inch Solid End Mills
	3	55	55	1	3	1 5/16	1 5/16	3/16	5/16	" " " 2½ to 4 inch Shell End Mills
×	4	55	55	1	3	1 5/16	1 5/16	1/4	5/16	" " " 4 and 5 inch " " "
	5	75	63	1½	4	1 3/8	1 3/8	1/4	5/16	Regular 12-Tooth Side and Spiral Mills
	6	78	66	1½	4	1 7/16	1 13/32	1/4	5/16	" 10- " " " " "
	7	81	69	1½	4	1 7/16	1 7/16	1/4	5/16	" 10- " " Mills
	8	81	69	1½	4	1 7/16	1 7/16	3/16	5/16	" 10- " Spiral Mills
	9	85	73	1½	4	1 7/16	1 7/16	3/16	5/16	" 9- " Side and Spiral Mills
	10	90	78	1¼	3¼	1	29/32	1/4	5/16	2 inch and 1½ inch End Mills Spiral Teeth
	11	90	78	1½	4	1 5/8	1 5/8	3/16	5/16	Regular 8-Tooth Side and Spiral Mills
	12	105	93	1¼	3¼	7/8	7/8	1/16	5/16	1½ in. End Mill, First Cut; ¼ in. and 1 in. End Mill Clearance cut
*	13	112	100	1¼	3¼	7/8		1/16	5/16	1¼ inch End Mill, First Cut - (Back of Tooth)

× We use inserted Tooth End Mills above 2½ inch wherever possible and have not made this Cutter

* We use End Mills in place of this and the 135 degrees Cutter for 1 inch Mills

AM. MACH.

TABLE 1. NEW CINCINNATI COARSE-PITCH MILLING CUTTERS

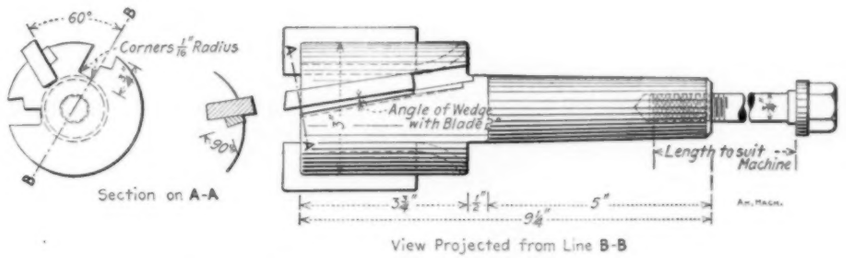


FIG. 2. THREE-INCH INSERTED-TOOTH END MILL

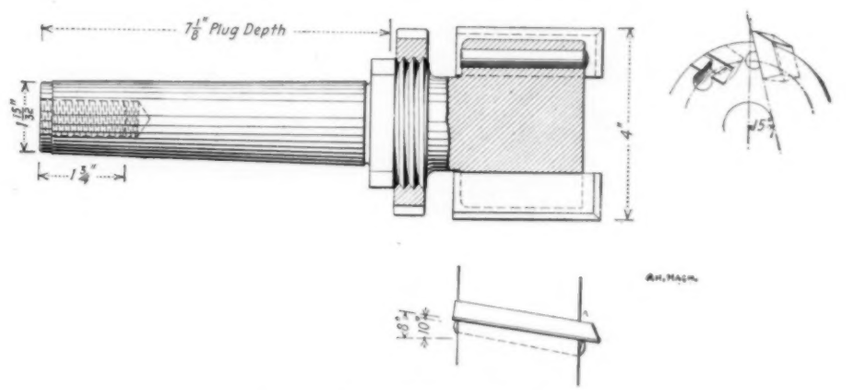


FIG. 3. EIGHT-TOOTH END MILL

DESCRIPTION OF CUTTERS

The cutters for milling teeth, as listed in Table 1, are all made with 10 teeth and a uniform included angle of point of 45 deg., making an included angle of tooth space 81 deg., using cutter No. 8 of the list as given. Where possible the cutters are made 4 in. in diameter, to go on a 1½-in. arbor, to permit full advantage to be taken of the construction of the cutters in selecting speeds and feeds for using them (see Fig. 1).

Cutters Nos. 1, 2, 3 and 4 of the list, which are used for cutting the end teeth in solid-end mills and shell-end mills, are made with one side straight. All others are made with an angle of 12 deg. on one side and the corresponding angle on the other side sufficient to make the proper included angle for the cutter and permit the making of spiral mills.

In the list, no cutters have been provided for making the four- and five-tooth spiral-end mills, except the 105 deg. cutter for cutting the face of the tooth. We

propose to use end mills for cutting the clearance on the back of the tooth. No cutters have been provided in this list for the milling of side teeth on side mills; but these can be made with the same proportions as those given in the list.

INSERTED-TOOTH END MILLS

The list of cutters given by Mr. De Leeuw, showed spiral-shell mills up to 6 in. in diameter. We have been having marked success with 3-in. and 4-in. inserted-tooth end mills, as shown in Figs. 2 and 3. The 4-in. cutters, Fig. 3, which were made for us by a cutter manufacturer, have the blades fastened with a taper pin. The 3-in. cutters, which were made at our own works, have the blades fastened with a taper wedge, which we have found very successful on cutters of small diameter, as it does not weaken the body of the cutter to the same extent that the pin does. This is an important consideration on inserted-tooth cutters of small diameter, because of the short distance from the axis of the cutter to the bottom of the blade slot. We have broken out the body between teeth in one of the 4-in. mills with taper pin, and have replaced it with a body of the wedge type.

It will be noted that the 3-in. cutter, Fig. 2, is made for a No. 11 B. & S. taper; but that the taper shank of the cutter body is shortened to a length of 5 in. It is our opinion that the extra length of the shank is unnecessary in cutters of this character, which are driven by the clutch slot in the end of the milling-machine spindle, and held in by draw-back bolts.

A. F. MURRAY,
Blake & Knowles Steam Pump Works.
Cambridge, Mass.

Boring on a Miller Aided by Scales and Verniers

Referring to the article by C. L. Goodrich, entitled "Boring Holes Accurately on the Miller," Vol. 35, page 918, and especially to the last paragraph in which he refers to his experience with the scale and vernier, I find that the results obtained by me from the method he criticizes have been far different. In other words I have never yet found any reasons for doubting the accuracy of work where the scale and vernier were employed.

Mr. Goodrich's way is without doubt accurate but it requires unnecessary work. It necessitates extra figuring, as the diameters of the plugs have to be taken into consideration and more mechanism is required in that the method is not so simple. The chances for inaccurate results, it seems to me, are increased, for the liability of the plugs not being parallel one with the other, and in a line parallel to the table travel, is great, and the difficulty of accurately measuring over two small plugs at some distance apart with a large micrometer is equally great.

The other day the foreman handed me a jig the drawing of which called for the boring of the five holes, *A, B, C, D, E*, Fig. 1. An illustration of the machine,

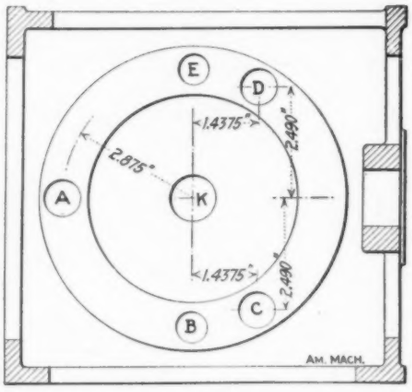


FIG. 1. JIG WITH HOLES TO BE BORED

Fig. 2, with the jig strapped to the table, is shown together with longitudinal and transverse scales and verniers at *F, G* and *H, I* respectively.

This job could have easily been done by means of the index head or the index head and vertical milling attachment if the miller was so equipped, as the

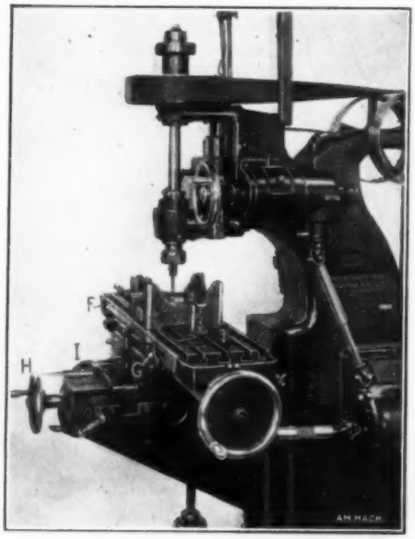


FIG. 2. MILLER WITH SCALES AND VERNIERS

holes were all in the same circle. I did it by the method illustrated because, I suppose, I worked on that machine more than any other. I proceeded with the work as follows:

After strapping the jig to the table and centering it by means of the hole *K*, Fig. 1, which had already been bored, I noted the readings on the verniers. As both the scales and verniers are adjustable I could have just as well set them to an even inch before going ahead, but this method is not necessary if care is exercised in taking the readings.

The readings, as stated, having been taken, I moved the table longitudinally to the right 2.875 in. and bored the hole *A*. Moving it back again to central I fed the table in a like amount and bored the hole *B*. As the next hole *C* to be bored was just to the right of the hole *B*, I moved the table to the left 1.4375 in. Subtracting 2.490 in. from 2.875 in. gave me 0.385 in., the distance I was to move the table out to bore the hole *C*. Following the same course, the holes *D* and E were bored except that *D* was bored before *E*, which was the logical procedure.

When the jig was completed, as is the custom in our shop, it was carefully inspected. It passed the inspection, which illustrates the point that insofar as my experience goes, I have been able to produce accurate work with the aid of the scale and vernier.

Providence, R. I. HARRY GRAY.

Difference Between Jig and Fixture

Pursuant to the question appearing in Vol. 36, page 155, "What is the difference between Jig and Fixture?" I propose, with Webster as the authority, these definitions: Jig. A small machine or handy tool; a contrivance fastened to or inclosing a piece of work and having hard-steel surfaces to guide the tool, as a drill; or to form a shield template to work to as in filing. Fixture. That which is fixed or attached to something as a permanent appendage, as the fixture of a pump, etc.; state of being fixed; fixedness.

While this does not directly apply to the machine shop, we might trace it back to the machine shop through the pump, also the prefix "Fix," to become fixed; to settle or remain permanently; to cease from wandering; to rest, etc. There is small reason for any confusion in the matter, other than that which exists in the minds of the various operators.

F. FENNIMORE.
Burlington, N. J.

Peat deposits within the limits of the United States are practically always formed in situations where water for the greater part of the year either saturates or wholly covers the plant débris from which peat originates. In those places where vegetable material is saturated with water for only a part of the time and is subjected to periodical and prolonged drying out, true peat is not formed, but a more nearly complete decomposition takes place that results finally in the formation of humus. From a bulletin on the uses of peat as fuel, published by the Bureau of Mines.

The Schloemann Gear Cutter and Slotter

In the operation of the Schloemann gear cutter and slotter, the gear blank is given a rolling movement which is produced through a simultaneous turning and cross movement of the table. The tool has a straight flank, and does not therefore work out the teeth like a forming tool. At the beginning of the operation the tool is set to the correct depth for the tooth; it remains so until the gear is finished, which eliminates variations in depth between the teeth.

Fig. 1 shows the initial and final positions of the gear; Fig. 2 illustrates the manner in which the tool performs the cutting operation. Big gears, which are to be cut on the machine, are first roughed out, as shown in Fig. 3.

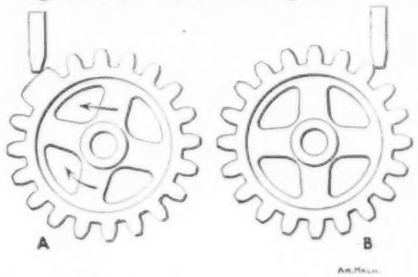


FIG. 1. THE INITIAL AND FINAL POSITIONS OF THE GEAR

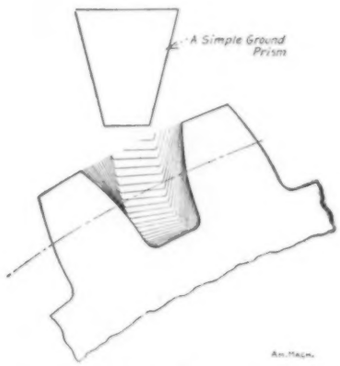


FIG. 2. THE CUTTING OPERATION

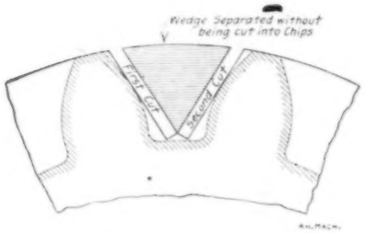


FIG. 3. BIG GEARS ARE FIRST ROUGHED OUT

The initial position is shown at *A*, in Fig. 1. The tool is out of the body of the gear and its front edge is tangent to the pitch circle of the gear. The gear then moves, as the arrow shows, upon the reciprocating tool, with a motion of rolling on the pitch circle. When the gear has reached position *B*, the tooth cavity is finished. The gear is then rotated a distance of one tooth, and the operation is repeated.

The table is given its rolling movement through an ingenious gear combination. By putting on or taking off a few change gears, the combination suitable to the work in hand is obtained. These change gears are used also for feeding the work around the distance of one tooth. The play of the change gears has no influence on the accuracy of the work, as they always rest on one side.

As can be seen by Fig. 4, the gear cutter has the design and working method of a slotter.

The following are some of the capacities of the machine, guaranteed by the makers, Edward Schloemann, g. m. b. H., Düsseldorf:

	For cast iron		For steel
Pitch	Depth of tooth	Time	Time
20	8 in.	6 min.	10 min.
30	12 in.	18 min.	27 min.
40	16 in.	26 min.	48 min.

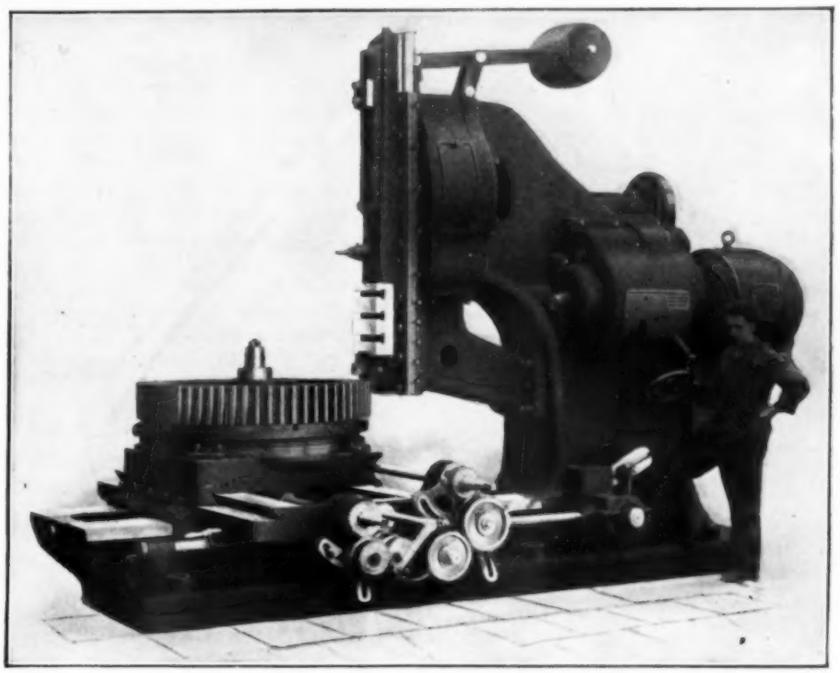


FIG. 4. THE SCHLOEMANN GEAR CUTTER AND SLOTTER

The Importance of Machine Tool Lighting

The illumination of factories, offices or apparatus may be effected in any of three ways, by general (diffused), by individual (spot) lighting or by a combination of the two. While the first method is much to be preferred, there is hardly an installation of any size where it can be employed exclusively. Recourse is therefore usually had to individual lighting as an accessory, and nearly all instances of successful interior illumination on a large scale may be said to consist of a combination of the two schemes with general lighting forming the major portion.

The subject of illumination has received such scant attention from the public at large that the tremendous strides made in it within the past decade have been as yet but dimly appreciated. As a result, the designing of lighting systems in many new office and factory buildings still continues to be left to the architect who, being as a rule totally unfamiliar even with the fact that there is any science connected with illumination, leans upon so called shop electricians for advice, with the natural consequence that the installations are in a majority of cases thoroughly bad. Further, where a lighting system has once been installed, the proposition is generally considered closed, never to be reopened as a whole, "patching" being instituted thereafter as occasion makes necessary, an individual lamp or a cluster being added or subtracted now and again, until even the original scheme, bad as it may have been, is entirely outclassed in this respect.

In any scheme of lighting there are certain fundamental requirements which must be fully met. These are: Uniform illumination, proper intensity, proper quality, reliability, accessibility.

When these conditions have been fulfilled the following results will be obtained:

Decrease in cost of operation and maintenance of the lighting system or increase in the quantity and quality of the lighting for the same cost.

Greater accuracy in workmanship, with consequent lessening of defective work.

Increase in production, with accompanying decrease in cost.

Reduced liability of accidents.

Lessening of eye-strain.

More cheerful surroundings.

Improvement in appearance and care of shop.

Easier supervision of the workmen.

The many types of lamps now available, covering all ranges of units from the lowest to the highest candlepower, enable a correct solution of practically every lighting problem to be made, so that little can longer be said in extenuation of poor lighting in any establishment; in fact, such a situation will soon be considered, and rightly, as one of the indications of bad business management.

There is little hesitation on the part of the average manufacturing concern in the spending of tremendous amounts of money for the purchase of machine tools where commensurate savings are likely to be effected. Such purchases are only made after supposedly the most thorough preliminary investigation in each instance, which is usually further reinforced by an actual demonstration involving an analysis of comparative expenses, time studies, etc., yet withal, the lighting of such tools on which so much depends, is almost invariably overlooked or else given but secondary consideration. The proper lighting of a tool should be looked upon as a part of the tool itself and, while costing far less in upkeep than many of the wearing parts, it is nevertheless just as important that the lighting be handled in exactly the same way and maintained at its highest efficiency.—C. B. AUEL, in the *Electric Journal*.

Metal Pans for the Pressroom

BY WARREN E. WILLIS

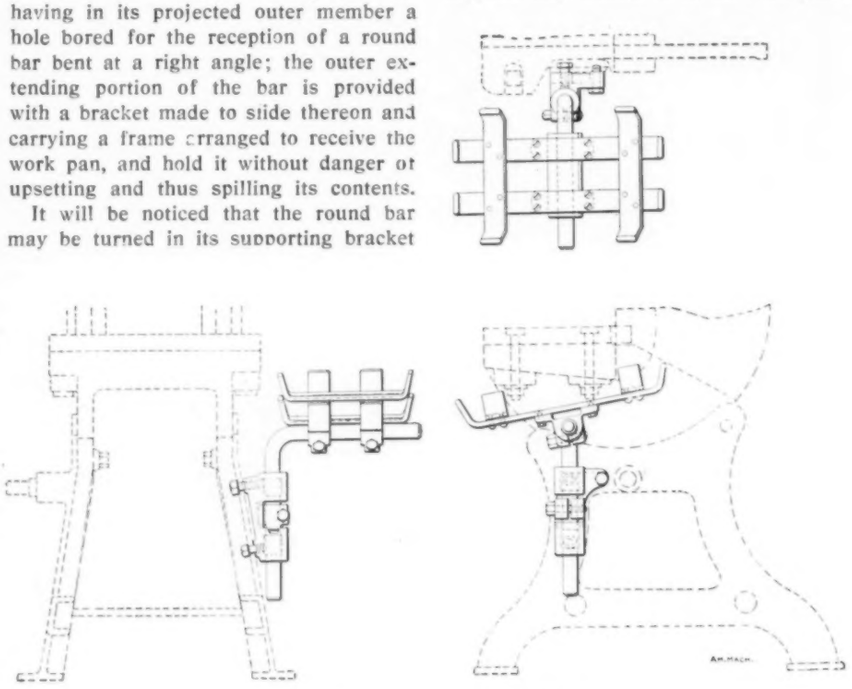
The generally untidy appearance of most pressrooms, particularly where small press parts are produced, is thought to be due to the means used for holding the parts in bulk as they pass from one operation to another; these means generally consist of wooden boxes of various sizes and shapes. These, irrespective of their condition when new, soon become oil soaked, and loose at their joints.

An improvement is noticeable where metal pans are used. They have a general similarity in appearance, are more useful and last longer. Moreover, they are usually so constructed as to retain any excess of the oils used in the various processes, prevent soiling the operator and oil soaking into the floor.

It is, of course, necessary to support such pans, with relation to the press, so that the operator, after a process has been performed, may conveniently take a part from one pan and drop it into another. The supports for such pans usually consist of castaway boxes more or less appropriate in height, strength and general adaptability, but they do not add to the neat appearance of the pressroom. The accompanying diagram shows an improvement to be attached to either or both sides of the press, which will support a metal or other pan in proximity to the press bed and which can be reached with ease by the operator.

The device consists of a bracket, to be secured to the legs of the press, and having in its projected outer member a hole bored for the reception of a round bar bent at a right angle; the outer extending portion of the bar is provided with a bracket made to slide thereon and carrying a frame arranged to receive the work pan, and hold it without danger of upsetting and thus spilling its contents.

It will be noticed that the round bar may be turned in its supporting bracket so as to adjust the pan in advance of the press bed, or allow it to be moved toward the rear, as may be desired; also that it can be raised or lowered to suit the convenience of the operator. The bracket disposed on the extending portion of the bar may be adjusted close to the bed or positioned farther away, also tilted so that the contents of the pan may be readily accessible to the operator as he sits or stands in front of the press.



METAL PANS FOR THE PRESSROOM

Such a device may be produced at a relatively small expense and entirely does away with the unsightly features previously mentioned. Moreover, it possesses far more strength than the average makeshift box support, while the adjustable features render it of great utility.

Effects of Temperature on Steel

BY WALTER M. BARNES

The subject, "Effect of Changes of Temperature on Steel Castings," Vol. 35, page 556, reminded me of a joke I once played on the foreman in the shop where I was employed as foreman-toolmaker, and it also served to educate him on a point with which he was not familiar.

We had just finished two plug gages of large size. I think they were 3 in. and 3¼ in. in diameter. It chanced that the 3-in. plug was lying on a surface plate near a window and was very cold; the 3¼-in. plug was near a steam radiator and was very warm, when both plugs were called for to be used in the machine shop for the first time.

I was a new man on the job and I suppose they wanted to be sure the plugs were O. K. before being used, so they tried them for accuracy with the micrometer and found the 3-in. plug 0.005 in. small and the other 0.0005 large. The general foreman was called and he obtained the same results and sent the plugs back to me.

As soon as I heard the complaint I divined the trouble, and after putting the cold plug on the radiator and the warm one in a bucket of cold water, a few minutes, sent for the general foreman and asked him to "show me." The expression on his face was a study, as he measured first one then the other, finding the one he had measured small was now large and the other small. The effects heat and cold will have on steel in contraction and expansion were then demonstrated, to his enlightenment.

Trade between Porto Rico and continental United States in the calendar year just ended amounted to 72 million dollars, or 18 times as much as in 1897, the year preceding the annexation of that island by the United States. Manufactures and foodstuffs form by far the largest part of the domestic merchandise shipped to Porto Rico from the United States. Telephones and scientific instruments formed $223,713 worth, while cars and carriages amounted to $1,557,135.

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.

505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

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Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.

Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1911, 1,358,200 copies. For January, 1912 (American weekly, American monthly, English weekly and German weekly), total, 92,750.

Of this issue, 22,250.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 145

American Machinist

Fixed Rates for Apprentices

In commenting on our recent editorial advocating the modern apprenticeship system, a contributor on page 231 questions the justice and advisability of paying apprentices fixed rates of wages throughout the term of apprenticeship.

The pros and cons of this question have often been discussed, but we believe experience has taught that, as a rule, no apprenticeship system has been permanently and successfully maintained unless it has had, as a basis, fixed rates of wages and a definite period of service. In fact it can hardly be called an apprenticeship system unless it is based on such conditions.

Without these conditions there remains only the loose arrangement which has proved so unsatisfactory in the past; an arrangement where a boy is simply given a job and allowed to learn the trade as best he can and where he may feel ready at the slightest provocation, or on account of an outside offer of more pay, to pull up stakes and leave.

Such a condition discourages the employer from giving the boy an all around training or from feeling any responsibility regarding his auxiliary school training. He feels it is too much risk to do these things for the boy who may come to him at any moment and demand more pay and leave if he does not get it.

On the other hand a definite agreement entered into with the boy and his parents or guardian, after a trial period sufficiently long to determine whether the boy is fitted for the trade, and so that those unfitted can be sifted out, settles these points of time and pay at the beginning so that the whole attention can be centered on training the boy.

If this training consists, as we believe, it should, in a carefully arranged schedule giving the apprentice experience in the various branches of the trade and providing for school work to supplement such training, then the matter of pay will become of secondary consideration.

We believe that this matter of giving the boy a variety of work and moving him from one department to another will do more to make him feel satisfied, and interested in his work even than the question of pay. This is illustrated by cases of which we have known where apprentice boys making good pay on job work of a character where there was considerable repetition, have asked their foremen for a change of work, even though they knew such a change would put them back on their regular apprentice rates.

Most shops have some system of job or premium work and part of an apprentice's work should be brought under such a system. Thus the brighter and more industrious boys can gain an advantage over others in this way, as well as in the more responsible character of the work with which they are entrusted.

One of the important matters for boys to learn during their apprenticeship is efficiency, including quickness, and nothing helps more in this direction than job work.

An apprenticeship is a training for life's work and the *character of the training* should be the prime consideration, and cannot be given too much attention. If the boy is accorded the treatment he should have along these lines, we believe that there will be little complaint regarding the matters of pay, or length of service.

Accident Compensation for Employees in Interstate Trade

We have frequently commented in these columns on the extension of the acceptation of the principle of compensation for industrial accidents as opposed to the older principle of employers' liability. This unmistakable trend is further shown by a special message of President Taft, submitted to Congress on Feb. 20, and accompanying the report of the Employers' Liability and Workmen's Compensation Commission. This commission was authorized in June, 1910, by a joint congressional resolution, "To make a thorough investigation of the subject of employers' liability and workmen's compensation and to submit a report through the President to the Congress of the United States."

The scope of the carefully drawn bill is indicated by its title: "A bill to provide an exclusive remedy and compensation for accidental injuries resulting in disability or death to employees of common carriers, by railroads engaged in interstate or foreign commerce, or in the District of Columbia, and for other purposes."

Without going into the provisions of the bill in detail, it is the most advanced piece of liability legislation yet presented. The common-law doctrine of negligence with the accompanying defenses of assumption of risk, fellow servant's fault, and contributory negligence, are done away with. Compensation is to be paid in every case, except where the injury or death is caused by the willful intent of the employee to injure himself or another, or in case of intoxication while on duty. The general basis of this compensation is an equivalent of one-half wages.

President Taft in his message gives this brief outline:

> Details of the bills are most admirably worked out. They provide for medical and hospital service for the injured man, for a notice of the injury to the employer, where such notice is not obviously given by the accident itself, for the fixing of the recovery by agreement; if not by agreement, by an official adjuster to be confirmed by the court and, if a jury is demanded, to be passed on by a jury.
>
> The amount of recovery is regulated in proportion to the wages received, and more or less serious character of the injury where death does not ensue, specific provision being made for particular injuries, in so far as they can be specified. The compensation is to remain in the form of annual payments for a number of years or for life. The fees to be paid to attorneys are specifically limited by the act. The remedies offered are exclusive of any other remedies. The statistical investigation seems to show that under this act the cost to the railroads would be perhaps 25 per cent. more than the total cost which they now incur.

The President then takes up and disposes of three objections to the validity of the bill. The first is whether under the provisions of the commerce clause the bill could be considered to be a regulation of interstate and foreign commerce. The

second is whether making these remedies exclusive, and compelling employers to meet obligations arising from injuries, is a denial of the due process of law enjoined upon Congress by the fifth amendment to the Federal Constitution. The third objection is that the right of trial by jury guaranteed by the seventh amendment of the Constitution is denied.

We do not need to repeat the arguments that are presented to meet these objections. The great object of this bill is to secure justice under existing industrial conditions. Another important result is expected if it becomes law. This is, the settlement, out of court, of suits for damages for personal injuries. It is estimated that the proposed system will serve to reduce the burden of our courts by one-half, thereby permitting disposing of other cases with much greater dispatch.

Francis H. Stillman

In the death of Francis H. Stillman, president of the Watson-Stillman Co., which occurred on February 18, a prominent figure in the machine-building industry was removed. His death came with almost tragic suddenness, Mr. Stillman having spent the previous day performing his regular work and in apparent perfect health.

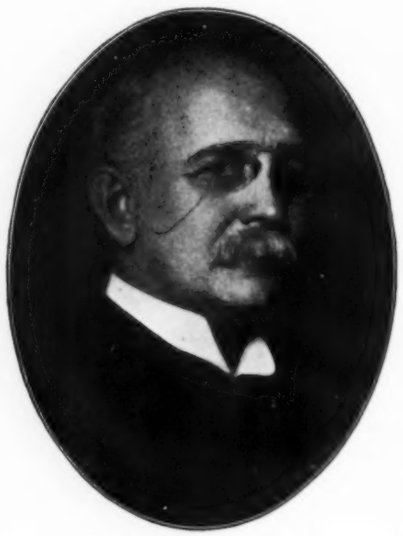
He was born in New York City, Feb. 20, 1850. At the age of 24 he graduated from the Sheffield Scientific School, Yale University and his first business connection was with the Cottrell Printing Press Co., of New York City. Later he was associated with his stepfather, Mr. Lyons, in the firm of Lyons & Co., of New York, builders of hydraulic machinery. In 1883 he organized the firm of Watson & Stillman, which succeeded Lyons & Co. His partner, Mr. Watson, died nearly a score of years ago and Mr. Stillman continued the business, which was incorporated in 1904, becoming the Watson-Stillman Co., of which Mr. Stillman was president to the time of his death. To his engineering skill in his company's special line, hydraulic machine-tool construction, and his organizing and executive ability, is largely attributed the company's conspicuous success.

Mr. Stillman was a member of many social and professional clubs and associations. He was the chief organizer of the Machinery Club, of New York City, and was its first president. He was a director of the National Association of Manufacturers, and was the first president of the National Metal Trades Association. Besides his interests in the Watson-Stillman Co., he was president of the Bridgeport Motor Co., of Bridgeport, Conn., and a director of other manufacturing concerns.

He was of an affable disposition and high business integrity, and his circle of warm personal friends was very wide.

The fact that Mr. Stillman was buried on what would have been his sixty-second birthday added a note of pathos to his sudden death.

Mr. Stillman was married to Miss Irene Bancroft, of Boston, Mass., who, with two sons, survives him. The sons, Austin F. and Edwin A., are both mechanical engineers and have been associated with their father in the Watson-Stillman Co.



FRANCIS H. STILLMAN

OBITUARY

William N. Epping, vice-president of the Epping-Carpenter Co., manufacturers of hydraulic machinery, died on Feb. 15.

Samuel M. Dodd, president of the Wagner Electric Co., St. Louis, died in that city on Feb. 16, aged 79 years. He was born in Orange, N. J.

S. D. Conover, founder of the Miami Valley Machine Tool Co., Dayton, Ohio, died Feb. 8, at the age of 69 years. Prior to a year ago Mr. Conover was president of this company but retired from active business on account of ill health.

Everett Norton, an inventor, 76 years old, died Wednesday in Bristol, Conn. Mr. Norton as a boy invented a loom to make crinoline hoopskirts, and later he took out twenty patents in five years for clock machinery. He was the inventor of the Bristol steel fishing rod.

Charles Hart, president and treasurer of the Hart Manufacturing Co., Cleveland, Ohio, died Feb. 9, aged 62 years. He had been in poor health for some time. Over 30 years ago he established the company of which he was the head. For some time its active management has been in the hands of his son, L. F. Hart, vice-president and treasurer.

Edwin H. Bennett, vice-president and general manager of the Singer Sewing Machine Co., died in Berlin, Germany, on February 21. Mr. Bennett went abroad four weeks ago to make the annual inspection of the company's plants in Scotland, Germany and Russia, and while in Glasgow caught a cold which developed into pneumonia while in Berlin. He was 45 years old and a native of Brooklyn, N. Y.

Henry O. Putnam, treasurer of the Putnam Machine Co., Fitchburg, Mass., for the past 40 years, died on Feb. 17, aged 71. After receiving a common-school education in Fitchburg he took up the machinist's trade, following in the footsteps of his father, Salmon W. Putnam. He later became foreman of the shop, which position he held until assuming the duties of treasurer. Mr. Putnam is survived by two sons.

John Burkitt Webb, who retired from the professorship of mathematics and mechanics at the Stevens Institute of Technology five years ago to practice his profession of consulting engineer, died at his home, in Hoboken, Feb. 18. He was seventy-one years old. Mr. Webb was a member of numerous scientific societies, and was known as the inventor of many devices for the measurement of power. The dynamophone in particular contributed to his fame in this phase of his career.

PERSONALS

W. S. Chase, general sales manager of the National-Acme Manufacturing Co., Cleveland, Ohio, sailed on February 24 for a several weeks' business trip through Europe.

V. M. Palmer, until recently chief engineer of the Sheldon Axle Co., Wilkes-Barre, Penn., has accepted a position as standardizing engineer, U. S. Motor Co., New York City.

P. F. Smith, Jr., who has been master mechanic of Pennsylvania R.R. shops, Columbus, Ohio, has been appointed superintendent of motive power of these lines at Toledo, Ohio.

John F. Allison, formerly connected with the Clemson College, S. C., has been appointed instructor of mechanical engineering and shop work at the Maryland Agricultural College, College Park, Md.

Percy H. Squier, formerly production specialist with the Blake & Knowles branch of the International Steam Pump Co., has recently been appointed superintendent of Clark Brothers Co., Belmont, N. Y.

Harry M. Latham, formerly mechanical engineer with the American Steel and Wire Co., Worcester, Mass., has become manager of the steam and electric departments of the B. F. Sturtevant Co., Hyde Park, Mass.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

Magnetic Chucks

The accompanying halftones show two types of magnetic chucks recently developed by the D. & W. Fuse Co., Providence, R. I.

The flat chuck shown in Fig. 1 has a horizontal face and is equipped with adjustable end and side stops, providing convenient means for locating and steadying the work on the surface of the chucks. This type is adapted for holding work for grinding flat surfaces, especially in the case of thin stock, which can be easily distorted by clamping.

Milling operations can be facilitated with this type of chuck where the shape of the work in such that the end stop of the chuck can be raised to take part of the thrust. When used in this way, the smallest flat chuck made by this company will hold a 1x2x6-in. bar of tool steel rigidly enough to mill 0.050 in. off the surface 2 in. wide, with a feed of 1 in. per minute.

The rotary chuck is shown in Fig. 2 and has found successful application in plants manufacturing ball and roller bearings, especially for holding ball races. It is also adapted for accurate grinding of pistons, and piston rings to fit the ring grooves. This type is equipped with an auxiliary plate as shown.

The magnet coils in these chucks are wound with Deltabeston wire, having a special heatproof insulation of pure asbestos. This insulation can safely withstand a temperature as high as 400 deg. F. The coil units are interchangeable, and the construction of the chuck is such that these units can readily be replaced without the necessity of returning the chuck to the factory in case of injury.

The auxiliary plates are used as jigs or fixtures for holding special or irregular shaped pieces, by means of which one chuck can be made to cover a wide range of operations, as any number of plates can be used with one chuck. The chuck ends are machined dead true so that several of them can be lined up end to end for holding long work, or for machining many small parts at one operation.

With the exception of the smaller sizes, the chucks are designed for use directly on 105-125 volt direct-current circuits. Where it is desirable or necessary to energize them on circuits of higher voltages, such as 210-250 volts or even 550 volts, a convenient form of auxiliary resistance is applied which may be inserted at any suitable point in the circuit. The small chucks are equipped with standard external resistance units for use on 105-125 volt direct-current circuits.

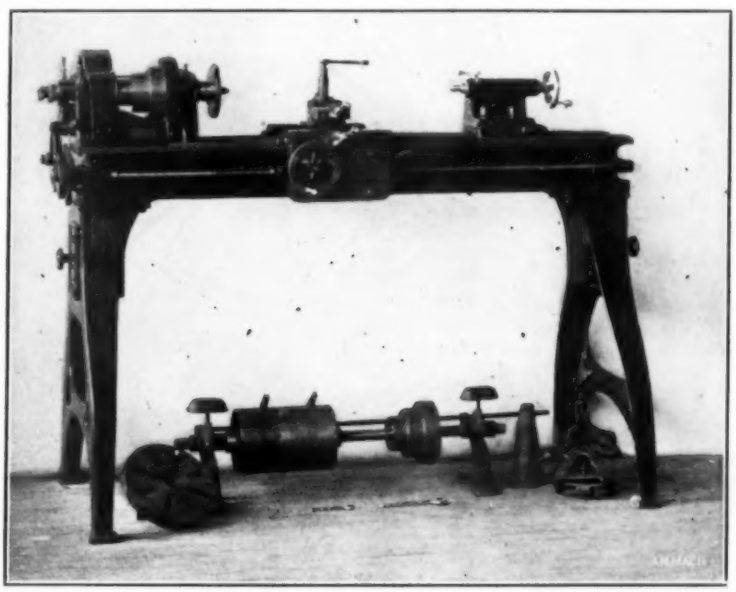
The chucks are both oil and waterproof, and are equipped with demagnetizing switches for readily releasing the work.

Double Backed Geared Lathe

The halftone shows an 11-in., 3-step cone, double backed-geared lathe, manufactured by the Worcester Trade School, Worcester, Mass.

The spindle is of high-carbon steel, ground. The bearings are of bronze. The end thrust of the spindle is sustained by a step bolted to the end of the headstock and entirely independent of the spindle. The tailstock is of the offset type, allowing the compound blocks to be set in a plane parallel with the bed. Provision is made so that the tailstock can be set off center for turning taper.

Positive-geared feed is provided for.



DOUBLE BACK-GEARED LATHE

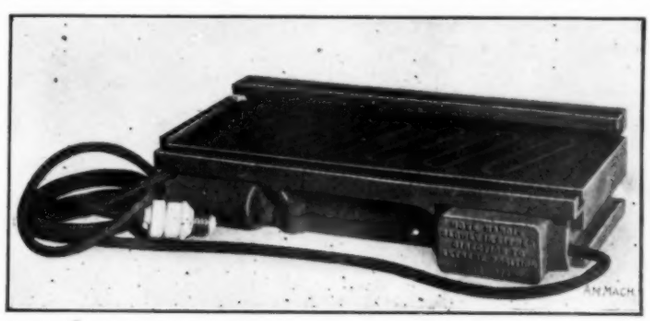


FIG. 1. FLAT TYPE OF MAGNETIC CHUCK

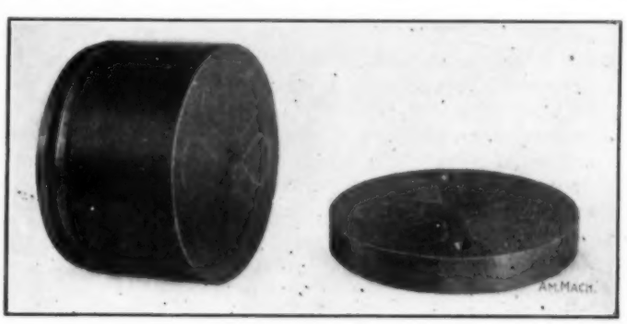


FIG. 2. ROTARY MAGNETIC CHUCK

The distance between centers, 5-ft. bed, is 34 in., the swing over the ways is 11¼ in., the swing over the compound rest is 8⅛ in. The machine weighs 650 lb.

Bench Lathe Grinding Attachments

The halftone, Fig. 1, shows an external grinding attachment for bench lathes, designed for grinding with ½-in. face and 4-in. diameter wheels. The grinding head may be removed and a head for internal grinding substituted. The spindle for internal grinding is capable of speeds up to 30,000 r.p.m. The circular swivel base is graduated in degrees to permit taper grinding. The lever movement is adjustable for quick, short strokes, as well as longer strokes.

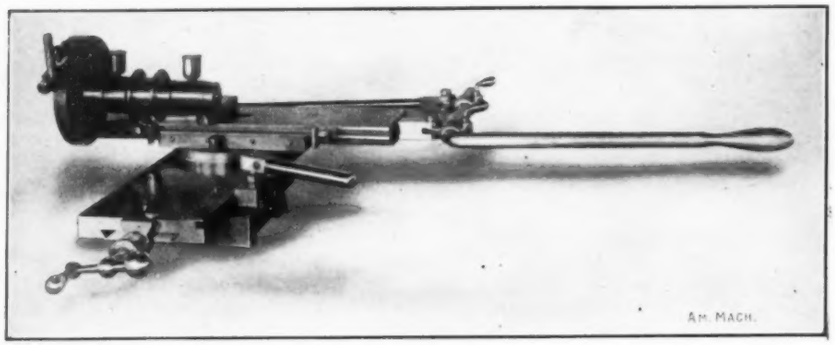


FIG. 1. EXTERNAL BENCH-LATHE GRINDING ATTACHMENT

The movement of the top slide gives a range of 8 in. for work to be ground, and is provided with adjustable stops. The cross movement is 7 in., from the center. The small lever over the micrometer feed screw is designed to release the feed and, by means of the pinion and rack, operated by a lever, the grinding head may be instantly carried away from, or returned to, the work. The emery wheel is covered, and is provided with an adjustable tube, to direct the flow of water, in wet grinding.

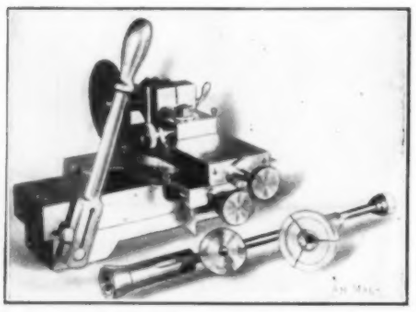


FIG. 2. BENCH-LATHE GRINDING ATTACHMENT

In Fig. 2 there is shown an external grinding attachment for the bench lathe for grinding irregular forms without the necessity of resetting for different angles. The illustration shows a paper cutter which has been ground on the plane, concave and bevel, in one setting. Fine adjustments have been provided throughout, both for setting the wheel and to compensate for wear. The circular swivel base is graduated in degrees for setting the wheel for different work.

Both of these attachments are recent developments of the Remington Tool & Machine Co., Boston, Mass., designed for work with their manufacturer's bench lathe.

High Power Borer, Driller and Tapper

In Fig. 1 is shown a Wigglesworth borer, driller and tapper designed for heavy work. The machine is capable of handling 4-in. drills in steel, and of pulling an 8-in. pipe tap in cast iron.

From the illustration it will be noted that the spindle remains in a fixed position, the head mechanism being fed down automatically on the column.

The machine is equipped with 9 changes of geared positive and independent feeds, ranging from 0.006 in. to 0.042 in. per revolution of the spindle, and three positive-geared leads for tapping, 8, 11½ and 14 threads per inch. These tapping leads are independent of the 9 feed changes. Any desired tapping leads may be obtained by means of extra change gears.

As will be noted, a belted connection is made on this machine, between the countershaft on the base and the quick-change speed-gear box on the top of the column. The countershaft carries tight and loose pulley 16x5 in. and runs at a constant speed of 400 r.p.m.

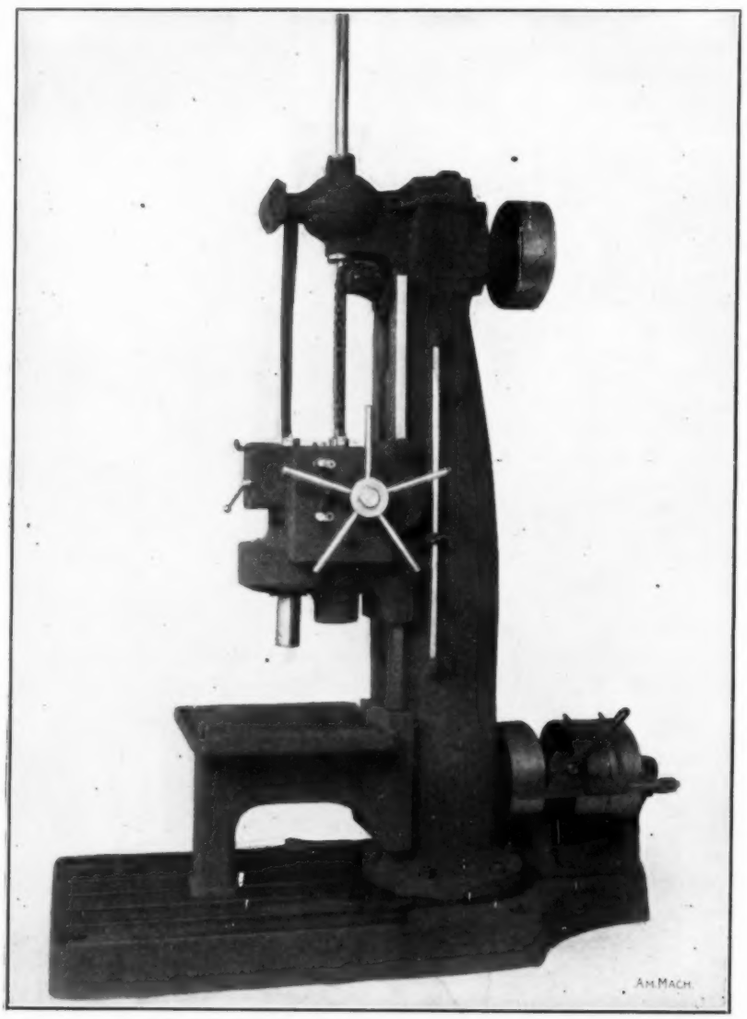


FIG. 1. HIGH-POWER BORER, DRILLER AND TAPER

In the speed-change gear box, 8 different spindle speeds, which are doubled in the head by means of back gears, are obtained. From the gear box, the power is transmitted to the head proper, then to a set of three bevel gears and a friction clutch, which form the reverse mechanism for tapping. The lever for operating this friction clutch is located conveniently on the left-hand side of the head.

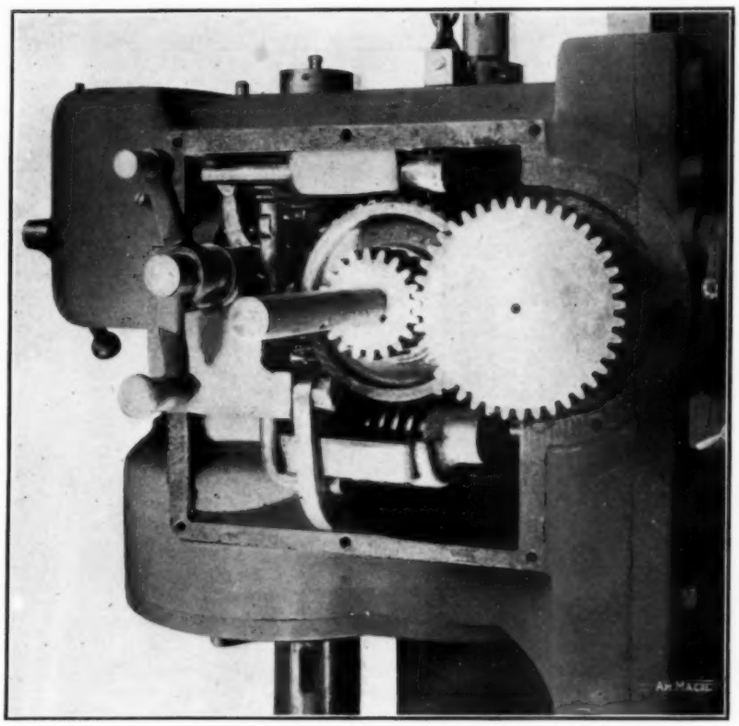


FIG. 2. POSITIVE-GEARED FEED MECHANISM

In the head, the spindle is driven by a large gear located in a fixed position, at the lower end of the spindle close down to the work. This arrangement is designed to reduce the torsional strains on the spindle.

In Fig. 2 are shown the details of the positive-geared feed mechanism. It will be noted that the power is taken from the spindle by means of a spiral gear on the shaft, and is transmitted from here through three spur gears in the small box on the front of the head. The gears in this box are changed for obtaining different tapping leads and in changing from one lead to another; it is only necessary to take off one gear and put on another.

On the under side of the table, below the center of the spindle, a hub is bored out and ribbed on the outer edges. Thus when a boring operation, like an open-end cylinder job, is to be performed all that is necessary is to drill and bore out a hole through the table into this hub and insert a bushing. The boring bar can be run through and steadied in this bearing.

The lubrication of this machine is automatic throughout. All gears in the head and quick-change gear box are steel or bronze and dip in a bath of oil, the head holding seven gallons of lubricant. The bearings are made self-oiling by laying a wick in a slot milled out of the bearing, the ends of the wick dipping into a reservoir of oil. In the case of the loose pulley on the countershaft the ends of the wick dip into a reservoir cored out of the hub.

The machine is a recent product of the Western Machine Tool Works, Holland, Mich.

Universal Vise and Surface Table

The vise shown in Fig. 1 has universal adjustment and is readily positioned to the convenience of the operator to take advantage of favorable light, as well as to avoid the necessity of uncomfortable positions.

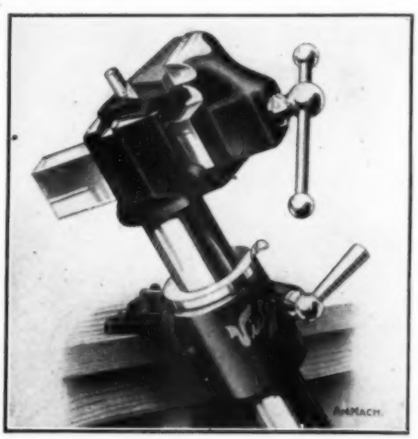


FIG. 1. UNIVERSAL VISE

There is but one clamping lever which holds the vise rigidly in all its positions, while the vertical position is automatically maintained by a locking collar in the stem until the clamping lever is tightened. This type of vise is made in four styles and four sizes.

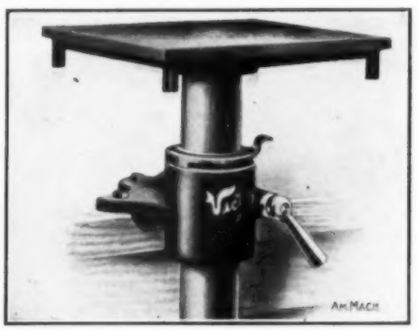


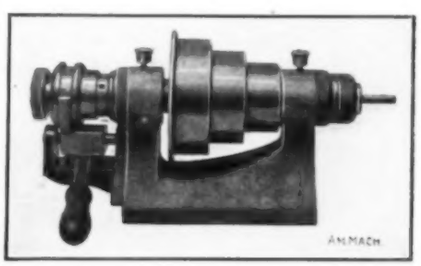
FIG. 2. SURFACE TABLE

The surface table shown in Fig. 2 is a handy accessory to the vise. It can be used in the base, as illustrated, or may be detached from the stem and used on the bench as an ordinary plate. It frequently happens that it is more convenient to have the surface plate raised than on a bench.

Both developments are recent products of the Victor Vise Co., Springfield, Ohio.

Automatic Chuck Closer for Small Lathes

The automatic chuck closer shown herewith is designed for releasing and binding the work while the lathe is in motion. It consists of a collar with three inserted jaws, swinging on pivots and with a sleeve on the outside of the collar which, when brought forward by means of the lever, compresses the forward end of the jaws causing them to rock and throw out the back end of the jaws against a collar, which comes in contact with the draw-in spindle. This draws in the split collet which binds the work, and when the lever is thrown backward the work is released.



AUTOMATIC CHUCK CLOSER

This device is a recent development of the Stark Tool Co., Waltham, Mass.

Sliding Head Driller

The accompanying halftone shows a regular all-geared 26-in. sliding-head driller, equipped with motor drive and special boring-bar equipment fitted up for boring, sizing and reaming exhauster bodies of vacuum cleaners. The exhauster bodies are 6 in. in diameter and 6½ in. deep.

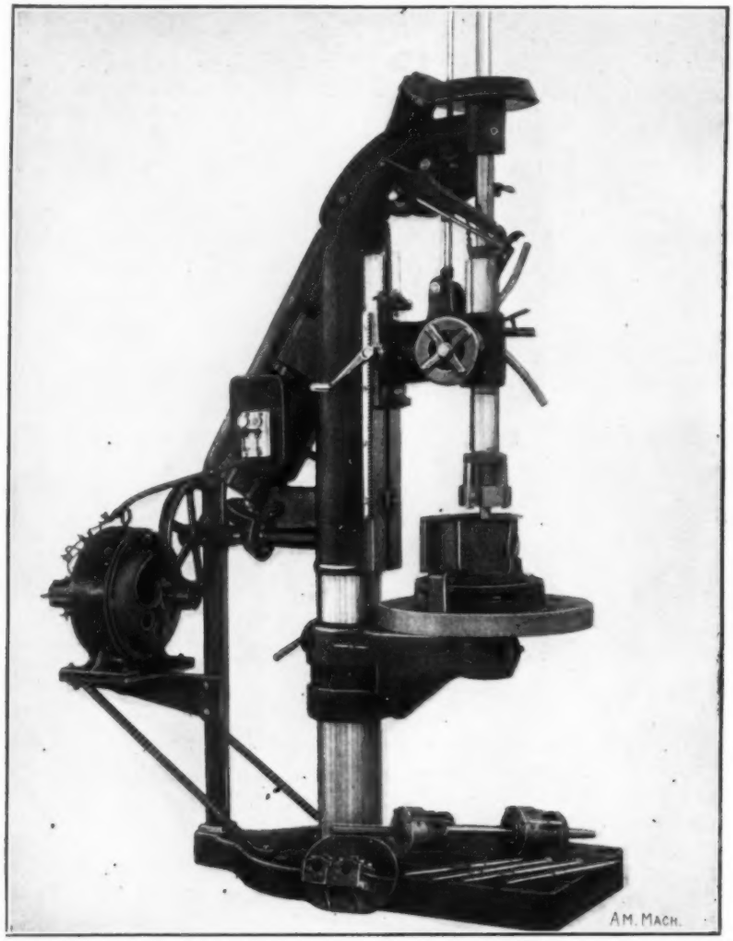
It will be noted that the boring heads are equipped with pilot bars, as this machine is also used for boring the bearings shown at the base, using the small cutter bars and reamers shown. The raising and lowering of the sliding head is readily accomplished by the rack and pinion.

The machine has eight geared speeds and eight geared feeds, obtainable instantaneously from the front of the machine. The spindle is 1⅛ in., and double splined. The sleeve has a 14-in. travel and the drift hole is below the sleeve. The crown-and-pinion gears are of large proportions and are cut four-pitch.

The head and spindle are counterbalanced, the weight being suspended by a roller-bearing sheave wheel. The head is gibbed to the column face, and is held at any point within its travel by two quick-acting clamp-screws. The head is raised and lowered by means of a crank pinior, operating in a rack.

The machine shown has a capacity for 2-in. high-speed drills driven at the rate of 8¼ in. per minute in cast iron.

This driller is manufactured by the Barnes Drill Co., Rockford, Ill.



SLIDING-HEAD ALL-GEARED DRILLER

Wheel and Chip Guards

The emery-wheel guard shown in Fig. 1 was designed to meet the requirements of the average shop-tool grinder, and will cover wheels up to 8 in. diameter and 1½ in. thick.

The guard covers the outside end of the spindle and nut completely, and the outside and face of the wheel, with the exception of sufficient grinding space for the average tool. The inside of the wheel is left uncovered.

The guard proper is supported by a steel rod which is clamped over the outside of the bearing box. This clamp is made in two pieces, held together by two capscrews, and clamped over the bearing box with two setscrews, locked with jam nuts.

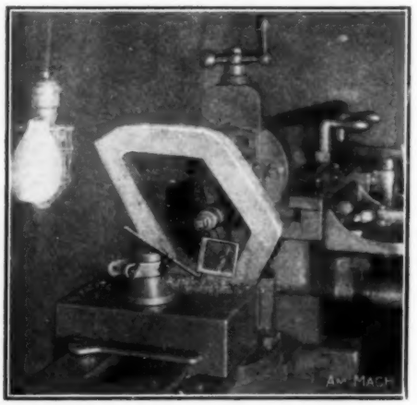


FIG. 2. CHIP GUARD

A chip guard is shown in Fig. 2 set up on an inside shaping job in which a stationary base block is used. The bottom of the block is covered with rubber which prevents slipping from the jaw of the shaper. The construction of the screen guard and holder is shown in the illustration. Both of these devices are recent products of the Universal Stamping Co., Buffalo, N. Y.

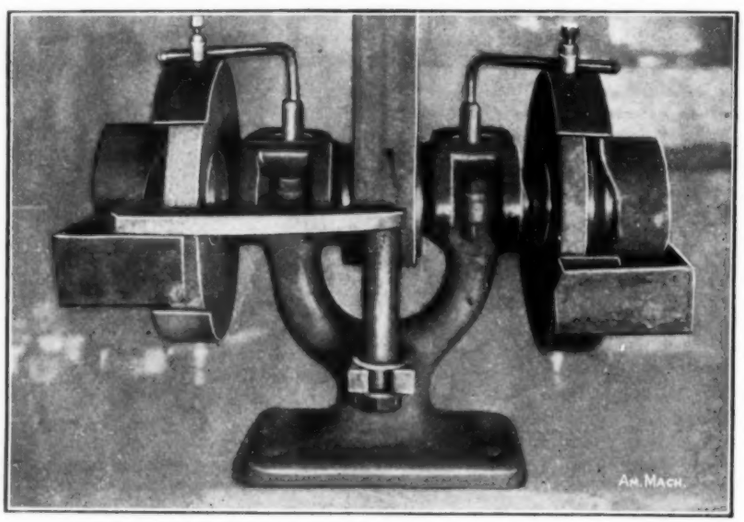


FIG. 1. EMERY-WHEEL GUARD

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

METAL WORKING

NEW ENGLAND

The top floor of the six-story brick building at 130-132 Lincoln St., Boston, Mass., occupied by A. M. Pretat Copper Plate Engraving & Printing Co., was damaged by fire, Feb. 15. Loss, $500.

The Taunton-New Bedford Copper Co., New Bedford, Mass., has awarded the contract to the H. B. Converse Co., Boston, Mass., for constructing a rolling mill, 120x353 ft., and a boiler house, 30x43 ft., of brick and fireproof construction. Charles W. Praray, New Bedford, is architect. Noted Feb. 8.

The Autogenous Welding & Manufacturing Co., Providence, R. I., will remove its plant from Borden St. to 291 Promenade St. The company will occupy the entire lower floor of the building.

The Universal Fire Escape Co., Woonsocket, R. I., has been incorporated with a capital of $100,000, and will locate a plant at Woonsocket for the manufacture of fire escapes.

The American Silver Co., Bristol, Conn., will erect a two-story factory. Plans are now being prepared.

E. N. Blanke will erect a garage, 20x30 ft., at Greenwich, Conn. L. C. Holden, 103 Park Ave., New York, N. Y., is architect.

The Henry & Wright Manufacturing Co., Hartford, Conn., maker of ball-bearing drilling machines, has purchased the plant at Hartford, Conn., formerly occupied by the Springfield Elevator & Pump Co. and the Parker Motor Co., into which it will move in March.

Work will soon be started on a large addition to the plant of the Geometric Tool Co., in Westville, a suburb of New Haven, Conn. The building will be two and three stories high, 182x50 ft., of brick, mill construction, with gravel roof.

MIDDLE ATLANTIC STATES

C. S. Ransom, 81 Chapel St., Albany, N. Y., will build a two-story machine shop, 35x80 ft., on Central Ave. It will be of brick and concrete construction. M. L. Ryder Building Co. is preparing plans.

B. Bell & Son Co., Ltd., manufacturer of agricultural implements at St. George, Ont., is planning the establishment of a plant in the United States for the manufacture of ensilage cutters, probably at Buffalo, N. Y.

Carl Hang, architect, Main St., Little Falls, N. Y., has completed plans for the erection of a two-story addition, 60x80 ft., brick, mill construction, for the Snyder Manufacturing Co., maker of bicycles, knitting machinery, etc.

Plans have been completed for a one-story foundry addition to the plant of the Fulton Machine & Vise Co., Lowville, N. Y.

The stock, machinery and patterns of the A. H. Wolff Gas Radiator Co., 399 Broadway, New York, N. Y., was damaged by fire, Feb. 17.

Bids will be received by Charles B. Stover, president of the park board, Arsenal Building, Fifth Ave. and Sixty-fourth St., until 3 p.m., Mar. 14, for the erection and completion of a boiler house for the Metropolitan Museum of Art, Fifth Ave. and Eighty-third St., New York, N. Y.

The Sterling Brass Works, Rochester, N. Y., making plumbing brass goods, has bought land in the eastern part of the city, as a site for a larger factory.

Onondaga Brass Co. is erecting a new factry at Syracuse, N. Y.

The Fishbach Motor Co., Newark, N. J., contemplates the construction of a factory at Perth Amboy, N. J.

Estimates are being received by H. B. Crosby, Jr., architect, First National Bank Building, Paterson, N. J., for a garage and loft building to cost $10,000 for the Crosby Estate.

The plant of the Newcastle Forge & Bolt Co., Newcastle, Penn., was partially destroyed by fire, Feb. 15.

A garage will be erected by Clarence Wolf, 204 Empire Building, Thirteenth and Walnut Sts., Philadelphia, Penn. Sauer & Hahn, 1112 Chestnut St., Philadelphia, are architects.

The L. Eckels & Son Manufacturing Co., 236 Gough St., Baltimore, Md., will erect a large engine room.

The car barns of the Washington Railway & Electric Co., at Washington, D. C., were destroyed by fire, Feb. 11. Loss, $250,000.

Bids are asked for the following articles by the Paymaster-General, United States Navy, Chief of the Bureau of Supplies and Accounts, Navy Department, Washington, D. C.:

Until 10 a.m., Mar. 12, Schedule 4348, Class 48, two horizontal oil pumps, duplex, with spares, for the collier "Jupiter," to be delivered at the Mare Island navy yard, Calif., within 60 days after receipt of award:

Class 11, one standard four-motor electric travelling crane, 75-ton capacity, with 15-ton auxiliary hoist, 43 ft. ½ in. span; Class 12, one No. 3 Newton new design bar cold-saw cutting-off machine; Class 13, one No. 2 Newton new design bar cold-saw cutting-off machine; Class 14, one steam hydraulic or pure hydraulic forging press of 800 tons capacity, with hydraulic arrangement for die changing and handling bars; to be complete with pump, steam, or pure hydraulic accumulator and all necessary piping, valves, etc.

Schedule 4362, Class 21, one standard sash, door and blind relishing and mortising machine, with power feed to mortising table; motor driven, direct-connected; to be complete in all respects, ready for erection: Class 22, one electric welder, complete in all respects, ready for erection; both to be delivered at the Norfolk navy yard within 30 days after award.

Schedule 4364, Class 23, one automatic horizontal hollow chisel mortiser, to be delivered at the Norfolk navy yard within 30 days after receipt of award.

Until 10 a.m., Mar. 26, Schedule 4363, Class 1, one electric spot welder, for delivery at the Puget Sound navy yard.

SOUTHERN STATES

The Berkley Machine Works, Berkley, Va., will enlarge its machine shops.

The Taylor Motor Co., Lynchburg, Va., will erect a garage. Estimated cost, $7500.

The Kline Motor Car Co., Richmond, Va., has had plans prepared for automobile works to consist of two buildings, each structure 60x600 ft., of brick construction with concrete foundation and concrete floor. James A. Kline is general manager.

The Gadsden Car Works, Gadsden, Ala., will improve its plant. Estimated cost, $20,000.

The Talladega Foundry & Machine Co., Talladega, Ala., has purchased the property of the Talladega Lumber Co., and purposes to remove its shops and install soil-pipe shop and steel foundry for making small steel castings.

Eureka Foundry Co., Chattanooga, Tenn., will rebuild its plant recently burned with a loss of $30,000.

The Stricklin Pattern Works, Chattanooga, Tenn., will rebuild its plant. Estimated cost, $3000.

The Illinois Central Ry. Co. has purchased land in Meridian upon which to erect railroad shops. Estimated cost, including equipment, $2,000,000. F. B. Barclay, McComb City, Miss., is master mechanic.

MIDDLE WEST

The Collings-Tayler Co., Cleveland, Ohio, will buy new machine shop and foundry supplies for its new factory.

The Lake Shore Sawmill & Lumber Co., Superior and East Thirty-eighth Sts., Cleveland, Ohio, will build new shops.

The plant of the Olive Foundry & Machine Works, Ironton, Ohio, was destroyed by fire, Feb. 5. Loss, $40,000.

The Rogers Supply & Tire Co., Columbus, Ohio, will equip a garage.

Plans are progressing for rebuilding the plant of the Miami Valley Tool Co.'s plant on Germantown St., Dayton, Ohio. The plant was recently burned.

P. M. Wege, Marietta, Ohio, has purchased a site on South Division St., Grand Rapids, Mich., and will erect a factory for the manufacture of metal furniture.

The Corrigan-McKinney Co., Cleveland, Ohio, will erect a steel plant and blast furnaces to cost $3,000,000.

The city of Cleveland, Ohio, will issue municipal bonds for $45,000 for the pur-

chase of fire-fighting equipment and the erection of fire-department buildings. Chas. W. Lapp is president of the city council.

Krebs Commercial Car Co., Clyde, Ohio, will equip a factory to manufacture motor cars. B. A. Backer is manager.

Plans are being prepared by Robert Crabb, 5607 Euclid Ave., Cleveland, Ohio, for the erection of a garage for Zwring Brothers.

The board of commissioners of Ottawa County, Port Clinton, Ohio, will receive bids until 10 a.m., Mar. 5, for the erection of a garage on the Court House grounds. W. H. Mylander is county auditor.

Fire destroyed $25,000 worth of stock and machinery of the Columbus Auto Brass Co., at Maple and Armstrong Sts., Columbus, Ohio, Feb. 13.

The U. S. McAdamite Metal Co., Brooklyn, N. Y., will establish a branch plant at Detroit, Mich.

The Sherwood Brass Co., brass founder and brass finisher, Detroit, Mich., will erect an addition to its factory.

Fire damaged the plant of the Detroit Seamless Steel Tubes Co., 841 Jefferson Ave., West, Detroit, Mich. Estimated loss, $8000 to $10,000.

Varney & Winter, architects, Equity Building, Detroit, Mich., will soon take estimates for the erection of the new four-story factory building, 328x56 ft., for the Metzger Motor Car Co., at Milwaukee Ave. and Grand Trunk R.R. Estimated cost, $150,000.

The Grand Rapids Ry. Co., B. Hackett, president, 38 North Ionia St., Grand Rapids, Mich., is having plans prepared for the erection of a new two-story and basement car barn on Bowery St. Estimated cost, $100,000.

The plant of the Hines Motor Co., Traverse City, Mich., was damaged by fire. Loss, $25,000.

The Wolverine Brass Works has awarded a contract for the construction of a foundry on Canal St., Grand Rapids, Mich.

Fire destroyed the plant of the Barnard & Leas Manufacturing Co., builder of flour-mill machinery, at Moline, Ill. The loss is estimated at $500,000.

C. W. Bradley, architect, Brown Building, Rockford, Ill., is receiving estimates for the construction of a two-story garage, 61x156 ft. Lee Stewart, 993 North Main St., is owner.

The International Smelting & Refining Co. has purchased a site at Calumet, East Chicago, Ill., where it will build a plant to cost about $500,000.

Byron Gregory, Bloomington, Ill., will erect a one-story garage, 40x80 ft. Estimated cost, $5000.

R. J. Balch, Chicago, Ill., will erect a two-story garage, 30x25 ft., to cost $4000. Plans are being prepared by A. G. Lund, architect, 49 West Sixty-third St., Chicago. The owner may be addressed in care of the architect.

The J. S. Rowell Co., Beaver Dam, Wis., manufacturer of agricultural implements, will increase the size of its plant.

Mrs. A. Zuerner will build a garage at 370-372 Grove St., Milwaukee, Wis., 50x150 ft., one and two stories high, of reinforced-concrete construction.

WEST OF THE MISSISSIPPI

The Lucerne Auto Co., Lucerne, Minn., will erect a five-story addition to its factory.

The Union Pacific R.R. Co. is planning to enlarge its shops at Fortieth and William Sts., Denver, Colo.

C. E. Rathburn, Denver, Colo., has taken out a permit to build a garage at Twenty-eighth and Java Sts.

WESTERN STATES

W. A. Wilson, North Yakima, Wash., is planning to erect a factory to manufacture a combined roller and ditcher of his own invention.

Grover T. Garland, Los Angeles, Calif., will soon commence the erection of a new commercial garage and repair shop on Tenth and Olive Sts., Los Angeles.

J. L. Kidwell, 730 Dolores St., San Francisco, Calif., has taken out a permit to build a new commercial garage and machine shop, estimated to cost $11,250.

Horace W. Lash, Pittsburg, Penn., is contemplating the erection of a plant for the manufacture of pig iron. A site will be acquired at San Francisco, Calif.

CANADA

The plant of the Canadian Locomotive Works, at Kingston, Ont., will be enlarged. Estimated cost, $1,000,000.

The Gas & Electric Motors Co., St. Thomas, Ont., will erect a new factory. E. P. Thomas is manager.

The Northern Bolt & Screw Co. will equip a large new factory at Owen Sound, Ont.

The Standard Chemical Iron & Lumber Co., Parry Sound, Ont., will erect a blast furnace and other buildings to cost $25,000.

E. D. Pitt, engineer and architect, 405 Victoria Ave., Niagara Falls, Ont., has prepared plans for the erection of a large structural-steel erecting shop, 78x228 ft., with concrete and tile gallery floors and roof, also fireproof japanning and impregnating building, for the Canadian Crocker-Wheeler Co., at St. Catharines, Ont.

The Chamberlain & Hockham Meter Co. will equip a large new factory in Montreal, Que.

The Jewel Carriage Co., Carthage, Ohio, has changed its name to the Ohio Motor Car Co. This concern will build a new modern auto factory on the Canadian border in the spring.

General Manufacturing

NEW ENGLAND

A building in Pepperell Square, Saco, Maine, occupied by Fred A. Burnham, candy manufacturer, was burned, Feb. 13. Loss, $1600.

J. Murchie & Sons, Calais, Me., whose sawmill plant was recently destroyed by fire, are to rebuild. New machinery will be purchased.

The Blood Knitting Co., Ellsworth, Maine, has been organized with a view to erecting a plant for the manufacture of knitted underwear. Plans for equipping with machinery will soon be completed. C. L. Morang is president.

A portable sawmill, owned by John C. Jones, Milton Road, Rochester, N. H., was destroyed by fire, Feb. 14. Loss, $1500.

The electric generator house of the Monadnock Mills, Claremont, N. H., was recently destroyed by fire. Loss, $6000.

George De Maas, manufacturer of wagons and carriages, Worcester, Mass., is contemplating the erection of a four-story wagon factory on Thomas St.

The Archer Rubber Co. is building a new factory on Central St., Milford, Mass.

The plant of the Purity Bedding Co., Broad St., Boston, Mass., was badly damaged by fire. Loss, $10,000.

The enameling plant of Chas. E. Sandland & Sons, North Attleboro, Mass., was badly damaged by fire. Loss, $8000.

Fire, caused by an explosion, totally destroyed the patent-leather factory of W. C. Welsh & Co., Woburn, Mass. Loss, $75,000.

The contract for the Cranston car barn, Providence, R. I., has been let. It will be 178x390 ft., two stories high. Noted Feb. 8.

The Interlaken Mills Co., Harris, R. I., is having plans prepared for the construction of a large weave shed at its plant.

The plant of the Standard Bottling Co., on East Ave., Pawtucket, R. I., was damaged, Feb. 15, to the extent of $2000 as a result of a fire which started in its bottling room.

The Acme Finishing Co., Pawtucket, R. I., has been capitalized at $225,000 and will take over the plant of the Harrison Yarn & Dyeing Co. New machinery will be installed.

The National India Rubber Co., Bristol, R. I., will manufacture insulated wire at its plant.

The Salt's Textile Manufacturing Co., Norwalk, Conn., will construct a new mill building. The structure will be one story, of brick.

Plans have been completed by R. W. Foote, 902 Chapel St., New Haven, Conn., for an addition to the plant of the West Haven Maufacturing Co., West Haven, Conn. It will be of brick, mill construction, two and three stories high.

Fire destroyed a hoisting-engine shed belonging to the New York, New Haven & Hartford R.R. Co., at Canal dock, New Haven, on Feb. 13. Loss, $2000.

The Pope Manufacturing Co., Hartford, Conn., manufacturer of automobiles, will erect a large addition to its plant.

Birdsey, Somers & Co., Bridgeport, Conn., corset manufacturers, will shortly commence the construction of a plant.

The American Thread Co., Willimantic, Conn., will soon start work on a large addition to its plant.

MIDDLE ATLANTIC STATES

The malt house of the Neidlinger Brewing Co., Oswego, N. Y., which was burned, entailing a loss of about $40,000, will soon be rebuilt.

The Regal Paper Co., of Pulaski, N. Y., will enlarge its plant.

The plant of the Victor Milling Co., Victor, N. Y., was totally destroyed by fire, Feb. 18. Loss, $50,000. A. L. Draper, Troy, N. Y., is president.

The building at 148 Thirty-ninth St., Brooklyn, N. Y., occupied by Alexander Smith & Co., carpet manufacturers, was damaged by fire, Feb. 17. Los, $25,000.

The top floor of the two-story brick building, at 409 West Fifty-fifth St., New York, occupied by the National Stone Renovating Co., was damaged by fire, Feb. 17. Loss, $1000.

The third floor of the five-story brick factory building at 139-143 Emerson Pl., New York, occupied and owned by E. Hamburger & Co., manufacturers of show cases and office furniture, was damaged by fire, Feb. 17. Loss, $50,000, covered by insurance.

Plans have been filed by A. G. Koenig, architect, 114 East Twenty-eighth St., New York, for the construction of a seven-story abbattoir, 70x110 ft., at First Ave. and 43d St. G. A. Harrington, 2170 Broadway, is the owner. The cost is $150,000.

R. V. Delapenha will soon construct a four-story, 60x80 ft., candy factory, at Poughkeepsie, N. Y. Percival M. Lloyd is the architect.

The stockholders of the Mott Wheel Works, Utica, N. Y., have voted to increase the capital stock from $150,000 to $300,000. Extensive improvements will be made to the plant. O. W. Mott is president.

The Hooker Electro-Chemical Co., Niagara Falls, N. Y., has increased its capital stock from $3,500,000 to $5,000,000. They will build a large addition to their plant as soon as the weather permits.

Fire destroyed the brush factory of Jay Gifford, at French Mountain, near Glens Falls, N. Y. Loss, about $15,000.

The Bingham Trunk Co., Buffalo, N. Y., will at once rebuild its factory on Mechanic St., which was recently destroyed by fire. Noted Feb. 22.

The Niagara Silk Mill Co., Tonawanda, N. Y., is having plans prepared for an addition to be made to its plant, on Sweeney St.

The Gilbert Knitting Co., Little Falls, N. Y., has plans nearly completed for two additional buildings to be erected at its plant on Main St. One building will be 100x100 ft., four stories and basement. The other building will be 78x138 ft., two stories, of brick, mill construction.

The ground floor of the four-story factory building at 299 Bushwick Ave., New York, was damaged by fire, Feb. 11. The building is occupied by Connor Bros., manufacturers of paper bags. Loss, $925.

The United Indurated Fibre Co. has broken ground for an addition to its plant, at Lockport, N. Y., 100x200 ft., one story. The extension will cost about $40,000.

The Batavia Rubber Co., manufacturer of rubber tires, at Batavia, N. Y., has increased its capital stock to $500,000, and contemplates the erection of a large addition.

The Eureka Candy Co., Rochester, N. Y., will erect a two-story candy factory and store in Central Ave.

It is reported that the Cobb Preserving Co., of Fairport, N. Y., will shortly reopen the canning factory at Canandaigua, N. Y., which has been closed for some time. New equipment will be installed, at a cost of about $15,000.

The American Mineral Wood Co., Poughkeepsie, N. Y., is planning to establish a branch factory, at Detroit, Mich.

The Atlas Mineral & Machinery Co., of Lincoln, N. J., has acquired property, at Fruitland, N. Y., where an earth-paint factory will be established.

The J. L. Schwartz Brewing Co., Buffalo, N. Y., has let a contract for the construction of a large addition to its refrigerating plant and bottling works. The building will be two stories, brick, 40x75 ft., and costing $50,000.

Gilroy & Raymond, for the United States Drug Syndicate, have acquired property at Goldens Bridge, N. Y., and will erect a milk dessication plant, utilizing skim milk and surplus milk from milk stations for the manufacture of malted milk and similar products.

The Montclair Jam Kitchens Co. has purchased 4½ acres of land, at Geneva, N. Y., and is erecting a large plant, to employ 200 to 250 hands in preserving berries and fruit.

The Health Chemical Co., of Yonkers, N. Y., has acquired property on the Saw Mill River Road, that city, and will erect a plant for the manufacture of dry fertilizer.

The Northern Hardwood Co., Watertown, N. Y., will operate a mill employing 50 men, located 10 miles from Harrisville, N. Y. It is planned to erect another mill about eight miles from the one now built.

Wade, Shannon & Co. has acquired land and will erect an ice house, at Cayuga, N. Y.

Plans for the construction of a new mill to be built at Easton, Penn., by John Crossley & Sons, carpet manufacturers, of Philadelphia, have been completed. The main building will be two stories high, 62x223 ft., and will cost about $75,000.

A five-story, fireproof, brew house, 64 x63 ft., at 172 West Girard Ave., Philadelphia, Penn., will be built by the Christian Schmidt & Sons Brewing Co., 127 Edward St. The cost will be $85,000.

Plans for the new million-dollar grain elevator, which is to be erected at Girard Point, Philadelphia, Penn., by the Pennsylvania R.R., have been submitted to that company. The elevator will have a capacity of 1,000,000 bushels.

Permits for the construction of the new plant of the Isaac A. Sheppard Co., at Erie Ave. and Sepviva St., Philadelphia, Penn., have been issued to William Steele & Sons Co., 1600 Arch St. A concrete foundry, 345x107 ft., will be built, at a cost of $40,000, and a three-story concrete factory building, 242x82 ft., at a cost of $75,000. Noted Jan. 25.

Plans for a two-story bottling house to be erected on the present site of the John Friedrich Bottling Works, 545 Rising Sun Lane, Philadelphia, Penn., have been completed. The building will be 51x88 ft., and cost $10,000.

Fire partially destroyed the lubricating oil plant of the Atlanta Refining Co., 3144 Passyunk Ave., Philadelphia, Penn., on Feb. 18. Loss, $80,000.

The Cudahy Packing Co.'s plant at New Castle, Penn., was badly wrecked by a gas explosion and fire. Loss, $18,000.

William H. Hooper & Sons Co., 56 Maryland Life Building, Baltimore, Md., manufacturers of cotton duck, are considering the erection of a four-story factory, 75x140 ft., of brick construction.

The Fidelity Cold Storage, Transfer & Ice Co., Hagerstown, Md., will erect an ice plant, 70x285 ft., costing $150,000. It will have a capacity of 75 tons per day.

New machinery will be installed in the addition to the Terminal Freezing & Heating Co., 430 South Eutaw St., Baltimore, Md.

SOUTHERN STATES

The Beechnut Packing Co. contemplates building a plant to manufacture corrugated paper boxes, at Fairmont, W. Va.

The plant of the Hazel-Atlas Glass Co., at Clarksburg, W. Va., is to be doubled in size. Additional ground adjacent to the plant has been purchased and preparations have been made to erect new buildings and install modern equipment in them at once.

The Rocky Mount Steam Baking Co., Rocky Mount, N. C., has awarded a contract for the construction of a fireproof manufacturing building, costing $15,000. T. L. Bland is president.

The Hosiery & Manufacturing Co., Robersonville, N. C., has erected a building, and it is reported will install hosiery knitting machines.

The Coe Mortimer Co., Charleston, S. C., has purchased a plot of ground, 400x 2530 ft., on the west bank of the Cooper River, and proposes to erect a fertilizer plant.

The Imperial Tobacco Co., Lake City, S. C., is having plans prepared for the construction of a $50,000 steamery and drying plant at this place. The structure will be located on Acline Ave.

Sam and Pleas Dillard, owners of the Cohutta Broom Co., have moved to Dalton, Ga., from Cohutta, and are planning to enlarge their plant.

Frank E. Block Co., Atlanta, Ga., will double capacity of factory, erect an additional story and install machinery at a cost of $20,000.

The Cranebrake Cotton Co., Birmingham, Ala., recently incorporated, with a capital of $80,000, will take over the Ellawhite Plant, purchased a short time ago by A. L. Morgan. S. T. Whitfield is president. This plant will be rehabilitated. Noted Feb. 15 under new incorporations.

The Southern Ice Co., Ellis Burnett, president, Montgomery, Ala., will install a 65-ton ice machine in its Montgomery plant, and a 100-ton machine in the Chattanooga, Tenn., plant.

The United Fruit Co., general offices, 131 State St., Boston, Mass., proposes to erect a 300-ton ice plant, in New Orleans, La., at a cost of about $250,000. C. H. Ellis is manager.

Pangle Bros. and Read Bros., Three Springs, Tenn., will enlarge their canning factory.

Fire damaged the plant of the News Publishing Co., Bowling Green, Ky. Loss, $5000, fully covered by insurance.

The Louisville Brick Co., Thirty-eighth St. and Rudd Ave., Louisville, Ky., has started the work of enlarging its plant from a capacity of 40,000 to 100,000 bricks per day. Manager Joseph Nevin has announced that new kilns will be built, new machinery installed and new steam tunnels constructed.

MIDDLE WEST

Improvements will be made at the plant of the Enterprise Enameling Co., Bellaire, Ohio.

The Sterling Grain Co., Mt. Sterling, Ohio, will erect a new grist mill and elevator. C. M. Neff is manager.

The Nolze Lumber Co., Chillicothe, Ohio, will buy some wood-working machinery.

The Toledo Plate & Window Glass Co., Toledo, Ohio, are erecting a large warehouse. George S. Heater is general manager.

The Butler County Canning Co., recently incorporated, will erect, at once, a new plant, at Monroe, Ohio. Charles Hinkle, president; Charles Longstreet, vice-president; A. T. Smith, secretary and treasurer.

The Dover Fire Brick Co., Strasburg, Ohio, will make improvements to its power plant.

The American Box Co., Cleveland, Ohio, will buy some new wood-working machinery.

The Star Mineral Waterworks Co., at Athens, Ohio, has increased its capital and will buy some new power-plant equipment.

The plant of the C. W. Stine Pottery Co., White Cottage, Ohio, was burned. Loss, $25,000.

The furniture factory of Lindow Liebius & Gerchow Co., at Toledo, Ohio, was destroyed by fire. Loss, $60,000.

The Hauck Brewing Co., 433 Dayton St., Cincinnati, Ohio, is having plans prepared for the construction of a five-story factory to be erected at its plant here. It will be 75x95 ft., and cost $75,000.

The pottery plant of C. W. Stone, at White Cottage, Ohio, was destroyed by fire, Feb. 16. Loss, $50,000. Insurance, $6000.

The Smith Lithographic Co., of Toledo, Ohio, will construct a new plant, 100x135 ft., on Summit St.

The Ullman-Philpott Co., Cleveland, Ohio, maker of paint, varnish and inks, will build and equip a large new plant.

The Liberty Grain & Stock Co., Liberty, Ohio, will erect a new elevator.

The Tippecanoe River Electric Co., Indianapolis, Ind., has been incorporated to construct electric-generating plants along the Tippecanoe River, near Monticello, Ind. The company is capitalized at $300,000 and will begin the work of erecting the plants within the year. Incorporators, J. W. Lilly, A. C. Ayers, W. D. Jones and others.

Fire, following a natural-gas explosion, destroyed the power plant of the Lapel Bottle Co., Lapel, Ind. John W. Bates is general manager.

The Goebel Brewing Co., Detroit, Mich., will erect an addition to its plant for its bottling department.

The Estey Furniture Factory, at Owosso, Mich., which was destroyed by a cyclone, will be rebuilt. Charles E. Rigley, president.

The Heim Carriage Works, at Marinette, Wis., was burned. Loss, $30,000.

Theodore Mackmiller, of Ashland, Wis., will build a cement-block factory this spring.

The J. I. Case Threshing Machine Co., of Racine, Wis., will erect a large factory this spring.

Plans are being prepared by C. F. Ringer & Son, architects, Hathaway Building, Milwaukee, Wis., for the proposed new printery and bindery of the Milwaukee Lithographing Co., 217-219 Third St., to be erected at Clybourn and Twenty-second Sts. The main building will be three stories high, 130x310 ft., with a two-story power house, 50x60 ft., all of reinforced-concrete construction.

The factory of the Bassett Echlin Harness Co., Janesville, Wis., was destroyed by fire, Feb. 12. Loss, $150,000.

The Milwaukee Dairy Supply Co., recently organized, proposes to erect a factory for the manufacture of automatic bottle-filling machinery, at Milwaukee, Wis. The capital stock is $25,000.

The National Box & Binding Co., Sheboygan, Wis., is in the market for new machinery for its new three-story factory.

The Plymouth Brewing Co., of Plymouth, Wis., is about ready to erect a new bottling house. Cost, $9000.

WEST OF THE MISSISSIPPI

The Ziegler Canning Co., of Muscatine, Iowa, is planning the construction of a $20,000 canning factory at Grand Junction, Colo.

Barrows & Stevenson, of Maquoketa, Iowa, are planning to build a canning factory.

W. L. Little will erect a canning factory at Marengo, Iowa.

The Bertha Dairy Association, Bertha, Minn., will erect a new creamery this spring.

G. L. Gagnon and Henry Crengle, Ronan, Mont., plan for the erection of a flour mill at Ronan. The plant will be fully equipped.

The Koken Barber Supply Co., Ohio Ave., St. Louis, Mo., has awarded a contract to the Hill-O'Meara Construction Co., Paige and Newstead Sts., for the construction of a factory building. The structure will be five stories high, 117x135 ft., of reinforced-concrete construction, and cost about $150,000.

The plant of the Banner Buggy Co., Main, Levee, Rutger and Convent Sts., St. Louis, Mo., was slightly damaged by fire, Feb. 13. Covered by insurance.

The Western Creamery Co. and the Twelfth Street Dairy Co., Kansas City, Mo., have consolidated and will build an ice-cream factory of reinforced concrete. Robert M. McCandish Engineering Co., of Kansas City, is preparing plans.

The Pichrel Co., manufacturer of gunstocks, formerly located at Chandlerville, has purchased a site on the North End Belt Line, north of the Natural Bridge Road, St. Louis, Mo., and will build a factory.

J. F. Rutherford, Jr., and W. Y. Ellis, Pine Bluff, Ark., will erect an ice plant with a capacity of 25 to 35 tons daily.

The Greenville Chair Co., Greenville, Tex., will construct a new factory, two stories high, 48x120 ft. A three-story finishing room, 96x120 ft., will also be built.

The Houston Ice & Brewing Co., Houston, Tex., has a permit for the erection of a reinforced-concrete and steel fireproof factory to be erected here. The estimated cost is $55,000.

The Waxahachie Cement & Stone Co., Waxahachie, Tex., is planning the erection of a brick plant.

Plans have been completed for the erection of a new plant for the Rex Steam Laundry, Galveston, Tex. The building will be one story, 120x84 ft., of fireproof construction. It will be erected at Nineteenth and Mechanic Sts.

The plants of the Houston Coöperative Manufacturing Co., and the Edward F. Farrel Lumber Co., both of Houston, Tex., were destroyed by fire, Feb. 21.

The Union Slaughtering Co., Galveston, Tex., T. F. Maurin, president, is considering plans for erecting a canning plant at this place. The estimated cost is $30,000.

E. F. Glaze has purchased the electric-light plant of the Edna Ice & Light Co., Edna, Tex., and will make improvements.

The Fredericksburg, Tex., electric-light and power plant is to be improved by installing two new dynamos. G. A. Pfeil is owner and manager.

The printing plant of Guessaz & Ferlet, 310 Navarro St., San Antonio, Tex., was damaged by fire, Feb. 11. Loss, $25,000. Covered by insurance.

The Kahn-Schaper Ice Cream Co., Galveston, Tex., will construct a bakery to cost $15,000.

The Fort Worth Shirt Factory, Fort Worth, Tex., will occupy a building at Eleventh and Throckmorton Sts., and equip it to manufacture shirts.

John Wooldridge, San Angelo, Tex., contemplates establishing a plant to manufacture a patented cotton gin.

It is reported that the Missouri, Kansas & Texas Ry. System will erect a plant at Waco, Tex., for removing lime from water, the cost to be approximately $100,000.

The Texas Bag & Fiber Co. contemplates the construction of a plant on the north side, Houston, Tex. Estimated cost, $500,000.

Work will soon be started on the new 50-ton ice factory to be erected by the Creamery Dairy Co., of San Antonio. The factory will be located near the compress on Hochheim St., Yoakum, Tex.

Power-plant equipment will be required for a new $40,000 sanatorium at Longmont, Colo., to be erected by the Sawyer-Elwood Sanatorium Co.

C. C. Lewis, Carlsbad, N. M., is preparing to enlarge his ice plant from five tons to 15 tons daily capacity. He will also erect a cold-storage plant.

WESTERN STATES

Plans have been received by the Phoenix, Ariz., branch of Armour & Co. for the construction of a three-story building to be erected on the north side of the Santa Fé tracks between Second and Third Aves. It will be of brick construction and will contain a smoke house, cold-storage department, and pickling plant, in addition to the offices of the company. The cost is estimated at $40,000.

The American Sugar Refining Co., Elida, Ariz., plans for the erection of a new sugar-refining plant, estimated to cost $2,000,000. A site will soon be acquired at Portales, Ariz.

The Lillywhite Bros., Colonia Morales, near Douglas, Ariz., plan for the erection of a new flour plant at Agua Prieta, Ariz. Work will commence at once.

The Northern Pacific Ry. Co. will build a tile factory at Auburn, Wash., in connection with the new freight terminal now under construction.

The New England Fish Co., Seattle, Wash., will build a new cold-storage plant at Ketchikan, Alaska, at a cost of

$73,000. Modern machinery will be installed.

Clyde R. Terrell, Montesano, Wash., contemplates the erection of a plant for the manufacture of incubators. Work will be commenced at an early date.

The Mount Vernon Cream Co., Mount Vernon, Wash., will increase the capacity of its plant. The company also plans to erect a new plant for the manufacture of tin cans. J. B. Agen is president.

The Union Mill Co., Edmunds, Wash., will rebuild the Brady lumbering plant recently destroyed by fire. Modern equipment will be installed.

The Palmer Lumber Co., Chehalis, Wash., will rebuild its lumbering plant, recently destroyed by fire. The plant will be fully equipped.

Within 60 days the Algoma Lumber Co. will begin the construction of its new mill at Melhase, Ore.

The Swiss Dairy Co., Portland, Ore., will soon commence the erection of a new creamery plant. Modern equipment will be installed.

D. A. R. Sprague, Berkeley, Calif., is superintending the construction of an intermittent vacuum precooling plant to cost $100,000, at San Benito, Tex., and contemplates the installation of a similar plant at New Orleans, La.

The Berkeley Butter Co., Berkeley, Calif., will soon commence the erection of its new proposed manufacturing plant.

The West Turlock Lumber & Mill Co., West Turlock, Calif., plans to increase the capacity of its lumbering plant. Theodore Sjoquist is manager.

The Los Angeles Can Co., Los Angeles, Calif., will construct a new manufacturing plant at an early date. H. Whitaker is interested.

F. W. Lang, Victorville, Calif., contemplates the erection of a large brewery at Victorville. Modern machinery will be installed.

The Buffalo Brewing Co., Sacramento, Calif., and the Meamber Bros., Yreka, Calif., will unite in a joint ownership of a bottling plant to be erected at Montague, Calif. A site will soon be acquired.

The Old Homestead Bakery, Los Angeles, Calif., has taken out a permit to build a new plant. Modern machinery will be installed.

CANADA

The Royal Block Powder Co., St. John, N. B., is planning the erection of a powder-manufacturing plant. Seven buildings will be erected. T. M. Block is president.

The Forest Reserve Pulp & Paper Co. will equip a new plant in Quebec. G. M. McDougall, Montreal, is manager.

The St. Lawrence Laundry Co. will equip a modern plant in Montreal. J. A. Mann is manager.

The Sanitary Packing Co., Toronto, Ont., will equip a new $150,000 plant at Niagara Falls.

The printing and stationery factory of R. Duncan, James St., Hamilton, Ont., was partly destroyed by fire. Loss, $200,000.

The Canadian Carbide Co., Merritton, Ont., will double its plant.

The sash and door factory of the McCormick Manufacturing Co., St. Boniface, Man., was burned.

C. E. Brown, of Medicine Hat, Alta., is interested in the construction of a glass and porcelain factory.

The Mountain Spring Brew Co. has received a permit to construct a $150,000 plant at Calgary, Alta.

The British Columbia Sugar Refining Co., Vancouver, B. C., has taken out a permit for extensive improvements and additions in its plant.

New Incorporations

METAL WORKING

The Matchless Heater Co., Holyoke, Mass., has been incorporated with a capital of $10,000 to manufacture hot-water heaters. The incorporators are G. C. Gill, G. P. Hosmer, Holyoke, and P. S. Sinclair.

The Hartford Special Machinery Co., Hartford, Conn., has been incorporated with a capial of $50,000 to manufacture machinery. The incorporators are E. W. Smith, E. T. Canfield and H. R. Shailer, Hartford.

The United States Agricultural Co., Hartford, Conn., has been incorporated with a capital of $100,000 to manufacture engines. The incorporators are L. C. Grant, S. A. Grant, Enfield, Mass.; F. H. Whipple and C. H. Cooley, Hartford, Conn.

The Barnes & Kobert Manufacturing Co., New Haven, Conn., has been incorporated with a capital of $20,000 to manufacture metal goods. The incorporators are B. Barnes, New Haven; F. P. Kobert, New York City, and J. E. Wheeler, New Haven, Conn.

The Superior Register Co., Canisteo, N. Y., has been incorporated with a capital of $500,000 to manufacture cash registers and apparatus. The incorporators are J. P. Langs, M. Cohen and F. Charmann, Niagara Falls, N. Y.

The North Avenue Garage Co., Fishkill Landing, N. Y., has been incorporated with a capital of $10,000 to carry on a general automobile business. The incorporators are R. S. Tompkins, R. S. Jones and D. A. Dugan, Fishkill Landing.

The Cross Lock Shingle Co., Geneva, N. Y., has been incorporated with a capital of $15,000 to manufacture shingles. The incorporators are W. C. Banker, G. C. Sherman and W. T. Seager, Geneva.

The Economic Twist Drill Co., New York, N. Y., has been incorporated with a capital of $200,000 to manufacture machinery dies and tools. The incorporators are W. H. Todd, J. M. Zurn and J. J. O'Brien, Brooklyn.

The Koerting & Mathiesen Co., New York, N. Y., has been incorporated with a capital of $25,000 to manufacture and deal in electrical supplies. The incorporators are H. R. Boker, 101 Duane St., H. Ryan, 335 Lenox Ave. and J. L. Suydam, 25 Broad St., New York City.

The Alhambra Garage Co., New York, N. Y., has been incorporated with a capital of $10,000 to do a general garage business. The incorporators are J. C. Graveur, 65 West One Hundred and Eighteenth St., M. Graveur and G. Kenney, 1921 Seventh Ave., New York.

The Rumely Products Co., Mineola, N. Y., has been incorporated to manufacture special machinery and agriculture implements. The incorporators are L. M. Rumely, A. J. Rumely, La Porte, Ind., and A. Potter, 25 Broadway, New York.

The Robert Gerson Co., New York, N. Y., has been incorporated with a capital of $10,000 to manufacture and deal in hardware. The incorporators are R. Gerson, 314 East Seventy-ninth St., I. Hersh, 1373 Franklin Ave., and I. Delberger, 283 Bowery, New York.

The Togograph Co., New York, N. Y., has been incorporated with a capital of $40,000 to manufacture machinery. The incorporators are W. Abramson, New York; M. Tahl and P. G. Plaine, Brooklyn, N. Y.

The M. M. Automobile Automatic Safety Signal Co., New York, N. Y., has been incorporated with a capital of $50,000 to manufacture automatic safety signals. The incorporators are J. C. McGee, 175 West Seventy-eighth St., W. F. Rawlins, 248 West One Hundred and Thirty-fifth St., New York, and I. M. Black, 419 Tenth St., Brooklyn.

The Walsh & Nelson Manufacturing Co., Brooklyn, N. Y., has been incorporated with a capital of $10,000 to manufacture machinery and tools. The incorporators are David Nelson, 1352 Fifty-fifth St., Brooklyn; Owen Walsh and John Booth, 271 Broadway, New York.

The Murray Wire Co., Newark, N. J., has been incorporated, with a capital of $125,000, to manufacture wire, iron and steel. The incorporators are P. J. Murray, A. Murray, Newark, and J. F. Macomber, New York, N. Y.

The Standard Automobile & Tire Co., Plainfield, N. J., has been incorporated, with a capital of $25,000, to manufacture motor vehicles and tires. The incorporators are H. P. Vosseller, J. J. Slevin and F. Ivamy, Plainfield.

The New York Steel Tire Co., Union, N. J., has been incorporated, with a capital of $25,000, to manufacture steel tires. The incorporators are: E. Ebel, A. F. Wahl, E. Wendland and J. Fulhaber, West Hoboken, N. J.

The Bonita Manufacturing Co., Camden, N. J., has been incorporated with a capital of $50,000 to manufacture hardware and hardware specialties. The incorporators are H. E. Rogers, F. B. Jess and A. R. Sloan, Camden.

The Frank Euler Electric Co., Elizabeth, N. J., has been incorporated with a capital of $90,000 to manufacture electrical devices and lamp sockets. The incorporators are Frank Euler, Jacob Reuter and R. W. Saile.

The Atlantic Spring Bed Co., 360 Bruce St., Newark, N. J., has been incorporated with a capital of $100,000 to manufacture bedsteads and couches. The incorporators are C. Beck, I. Beck and L. Sender, Newark.

The Diamond Block Machine Co., Bristol, Va., has been incorporated with a capital of $5000 to manufacture machinery. The incorporators are L. T. Lowe and G. M. Warren, Bristol, Va.

The Sherman-Lucas-Smith Co., Chattanooga, Tenn., has incorporated with a capital of $100,000 to manufacture transmission machinery. The incorporators are Morris Sherman, James Lucas, Thomas L. Smith and others.

The Union Boiler Co., 511-515 Water St., Toledo, Ohio, has been incorporated with a capital of $100,000 to manufacture machinery and boilers. The incorporators are J. M. Youngs, E. Radbone, I. A. Coby and U. G. Deaton.

The Gem City Register Co., Dayton, Ohio, has been incorporated with a capital of $15,000 to manufacture all kinds of registers. The incorporators are J. B. Lehman, Clyde McClure, Homer McClure, Harry N. Routzohn and L. Barkalow.

The Automatic Metal Shade Adjuster Co., of Columbus, Ohio, has been incorporated with a capital of $20,000 to manufacture a patented metal shade for all kinds of windows. The incorporators are Charles H. Eglehoff, James H. Hutchins, William H. Dickinson, W. H. Dickinson, Jr., and John K. Henry.

The United Auto Supply Co., Cleveland, Ohio, has been incorporated to manufacture and sell auto supplies. The incorporators are C. J. Castle, C. A. Fagan and W. J. Schur.

Business Items

The Vermont Machine Tool Co., Windsor, Vt., has been incorporated, to manufacture a multiple-spindle automatic turret driller, designed by G. O. Gridley, of the Windsor Machine Co.

In the announcement of the reorganization of the Bausch Machine Tool Co., which previously appeared in this column, mention of F. E. Bocorcelski as vice-president, in the list of officers, was inadvertently omitted.

The West Haven Manufacturing Co., New Haven, Conn., has purchased the business of William A. Peck and will continue to manufacture the line of mechanics' tools formerly made by him. Mr. Peck is now identified with the West Haven Manufacturing Co., and will superintend the manufacture of these tools.

F. W. Boye, Jr., and W. T. Emmes have purchased the interest of W. A. Schumacher in the firms Schumacher & Boye and Schumacher, Boye & Emmes, Cincinnati, Ohio, and have incorporated a new company under the name of the Boye & Emmes Machine Tool Co., to take over these two concerns. Mr. Emmes has been connected with the firm of Schumacher & Boye as general superintendent for a number of years. The firm Schumacher & Boye has been in existence for about 14 years.

The Lea Equipment Co., who have heretofore had their general offices in New York City, have found it necessary to enlarge their manufacturing facilities to accommodate growing trade, and have moved these offices to the works, at the corner of Stenton & Wyoming Aves., Philadelphia, Penn. They retain quarters in the West Street Building, New York, from which point the export and eastern trade will be served by their president, Albert G. Lea. H. R. Williams is general sales manager.

The Vulcan Engineering Sales Co. has been organized and incorporated, with offices in the Fisher Building, Chicago, and 30 Church St., New York. The company controls the entire product and will handle all sales of the Hanna Engineering Works, of Chicago, Mumford Molding Machine Co., of Plainfield, N. J., and Q. M. S. Co., of New York. Further factory arrangements are under way and the Vulcan company will own and manufacture a number of railway special tools and equipment for shop and maintenance departments. The officers are H. K. Gilbert, president, formerly vice-president of the Buda Co., and P. W. Gates, secretary and treasurer, now president of Hanna Engineering Works.

Trade Catalogs

The National-Acme Manufacturing Co., Cleveland, Ohio. Pamphlet. Spring dies. Illustrated, 10 pages, 5x7 in.

The Heald Machine Co., Worcester, Mass. Booklet. "Oversize Standards for Pistons and Rings." Illustrated, 16 pages, 6x9 in.

The Ferro Machine & Foundry Co., Cleveland, Ohio. Treatise. Marine Engines and Equipment. Illustrated, 48 pages, 9x12 in.

Westinghouse Electric & Manufacturing Co., Bloomfield, N. J. Pamphlet. Series 3003, Section L 200. Factory Lighting Problems. Illustrated, 30 pages, 6½x9 in.

Smith-Booth-Usher Co., 228-238 Central Ave., Los Angeles, Cal. Catalog A. Machinery, supplies, pipe and fittings, irrigation and power plants, equipment for mines and mills. Illustrated, 576 pages, 7x8 in.

The Industrial Instrument Co., Foxboro, Mass. Bulletin No. 58. Thermometers and thermographs for indicating and recording temperature. Illustrated, 24 pages, 8x11 in. Bulletin No. 59. Recording liquid level gages. Illustrated, 12 pages, 8x11 in.

Forthcoming Meetings

American Society of Engineer Draftsmen. Regular Meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Hotel Bellevue. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month, Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

American Boiler Manufacturers' Association, in conjunction with Supplymen's Association. Twenty-fourth annual convention, New Orleans, La., Mar. 12-15. J. D. Farasey, secretary, East Thirty-seventh St. and Erie R.R., Cleveland, Ohio.

American Society for Testing Materials. Annual meeting, New York City, Mar. 28-29. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Master Boiler Makers' Association. Sixth annual convention, Fort Pitt Hotel, Pittsburg, Penn., May 14-17. J. Rogers Flannery, secretary arrangements committee, Flannery Bolt Co., Pittsburg, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Connecticut

MODEL MAKER—First-class on instrument work, such as taximeters, speedometers, carburetors, odometers, counters, etc.; a man with ability to carry out inventor's ideas. One with technical training preferred; must have phlegmatic disposition and not be easily discouraged; must be just as ambitious to succeed while working out another's ideas as his own, even though he considers his own better, and yet may feel free to make any suggestions that will in his mind be desirable. Box 929, Am. Machinist.

Indiana

FOREMAN for machine shop in factory employing 100 men; must be first-class die and tool man and accustomed to light, fairly accurate work; salary, $27.50 weekly; in applying write fully in first letter. Box 6, Am. Machinist.

Kentucky

SUPERINTENDENT—High-grade man as superintendent of large typewriter manufacturing company; must be a man of wide experience whose qualifications are such that he can command and maintain the respect of the officers over him and the foremen and other employees under him; must have the ability to direct all the manufacturing departments and must thoroughly understand the construction of tools and dies; will pay good salary; position offers great opportunity for the right man; in replying state age, experience, present employer, salary expected and how soon can report; reply will be treated in strict confidence. Box 4, Am. Machinist.

Maryland

SPOON MAKER—Must be experienced and familiar with uptodate methods of making retinned steel spoons, knives and forks; good opportunity for right man; give references. Address "Expert," Am. Machinist.

Massachusetts

TOOL MAKER—First-class workman required with experience in designing labor-saving tools. Address, stating age, experience and pay required, Box 983, Am. Machinist.

STOCK LEDGER CLERK, experienced, by a large manufacturing concern in Massachusetts; excellent opportunity for A1 man; state age, married or single, salary expected, references and experience. Box 7, Am. Machinist.

PRODUCTION and routing man wanted for foundry and machine shop; preferably a machinist or man well versed in machine-shop practice; must be a hustler; you will be judged by your first letter; make it complete and comprehensive. Box 9, Am. Machinist.

Michigan

A MAN acquainted with form tool work; one with some experience in gear-cutter work preferred. Box 982, Am. Machinist.

DRAFTSMAN—One who has had experience in mixing and agitating machines, also conveying and flour mill machinery; state experience and wages expected. Box 861, Am. Machinist.

A LARGE manufacturing concern offers exceptional opportunity and chance for advancement to young men who are good mechanics as workmen; if you are thoroughly experienced, ambitious, a hustler, of good character, and have ability to direct others to increased efficiency, address Box 896, Am. Machinist.

Missouri

DESIGNER—Experienced jig and tool designer; one who has had experience on small rapid working jigs and tools; state age and references as to where you have produced results. Address Superintendent, Century Electric Co., St. Louis, Mo.

New Jersey

TOOL DESIGNERS—Several first-class. Apply Crocker-Wheeler Co., Ampere, N. J.

DESIGNER—An A1, on heavy pumping-engine work; only high-speed men need apply. Worthington Hydraulic Works, Harrison, N. J.

New York

DESIGNER AND DRAFTSMAN on machine tools and special machinery; good opportunity for first-class man; state age, experiences, references and salary expected. Box 985, Am. Machinist.

FIRST-CLASS horizontal boring-machine and planer hands; permanent position and good opportunity for advancement, if competent; state experience and wages expected. Box 924, Am. Machinist.

FOREMAN, to take charge of light manufacturing in sheet-metal stamping and die work; must be familiar with dies, jigs and uptodate manufacturing methods; give experience, references and state wages expected. Address "Good Chance," Am. Machinist.

MECHANIC, graduate, as electrical engineer wanted for a responsible position in maintenance department of large manufacturing plant in New York City; excellent opportunity for advancement to man who will show results; first year's salary, $1200. Address "Mechanic," Am. Machinist.

FOREMAN—Must be a hustler, good mechanic, sharp manager, and uptodate on piece work and latest shop practice; man having experience on such work as carburetors, mechanical lubricators, oil pumps, etc., preferred; give age, reference, experience, salary expected, and where now employed or no attention. Box 980, Am. Machinist.

SHOP SUPERINTENDENT wanted for machinery-manufacturing plant in the East, employing about 500 men; a thoroughly reliable and earnest man of experience is required who can produce good results at minimum cost; must be familiar with best shop practice and fully capable of handling men to advantage; the position requires a man of good executive ability; in answering state age, experience and salary expected. Box 986, Am. Machinist.

Ohio

AGENTS—"Mechanics for Everybody," a new monthly magazine, wants agents; best proposition ever made. Caxton Building, Cleveland, Ohio.

MANAGER for machine shop, thoroughly familiar with Corliss pumping machinery and air compressors; must be a mechanical engineer, technical graduate, with both selling and shop experience; give reference, state age, experience and salary required. Box 8, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

TOOL MAKERS—Several first-class tool makers, experienced on small, accurate die work; state experience and salary wanted. Box 811, Am. Machinist.

LATHE HANDS and tool setters, Potter & Johnston automatic. Apply to employment department, Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

MECHANICAL DRAFTSMAN, by first-class concern, manufacturing knitting machines; man with considerable practical shop experience preferred; state age, experience, former employments and salary expected. P. O. box 579, Reading, Penn.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Virginia

MECHANICAL DRAFTSMAN — One third-class, at $4.48 per diem; a competitive examination will be held at the Navy Yard, Norfolk, Va., Mar. 7, 1912, for the purpose of filling the above position. For further information address Commandant, Navy Yard, Norfolk, Va.

Wisconsin

FOREMAN for machine shop employing about 50 men; must be up to date in modern methods of manufacturing small interchangeable parts, and a good executive; give previous experience, age and salary expected; state full particulars in first letter or no attention paid. "X Y Z," Am. Machinist.

Positions Wanted

California

DESIGNER—Mechanical engineer from the East, middle aged, married, desires position in California as designer or chief draftsman; thoroughly familiar with uptodate shop methods and handling of men; factory experience; expert tool designer; A1 references from most prominent concerns; connected with present firm 11 years. Box 3, Am. Machinist.

Connecticut

FOREMAN—Tool-room foreman, or other responsible position; broad experience with leading corporations, on equipment, manufacturing and system, for varied lines of small and medium size product; ambitious and thorough mechanic. Box 969, Am. Machinist.

Indiana

DESIGNER, familiar with machine tools, jigs and fixtures, presses, dies and tools for sheet-metal manufacturing. Box 18, Am. Machinist.

Massachusetts

GERMAN MECHANIC and constructor, with 25 years' experience in making apparatus, blocks, tools and small machinery, like to start a little modern model and experimental shop in New York; desires connection with a single concern about experimental or other precise work in this line. Box 13, Am. Machinist.

Michigan

CHIEF DRAFTSMAN—Six years with automobile concerns as designer of tools for interchangeable manufacturing, planning work and buying standard tools; executive ability. Box 21, Am. Machinist.

New Jersey

DRAFTSMAN, experienced in checking machine shop, tool room, instrument and vacuum-cleaner work; also interchangeable tools. Box 20, Am. Machinist.

FOREMAN—American, practical mechanic, executive and instructor, desires position with progressive firm, assembling or machining. Box 16, Am. Mach.

MECHANICAL ENGINEER, graduate, thoroughly understanding the design and manufacture of electric commercial vehicles, desires position; age, 27; married. Box 5, Am. Machinist.

MECHANICAL DRAFTSMAN, with experience electrical appliances, interchangeable parts; power and plant work; can act as superintendent or assistant. Box 23, American Machinist.

New York

MECHANICAL DRAFTSMAN, various experience, wishes position. Box 999, American Machinist.

DESIGNER, experienced in designing special and automatic machinery, wants position. Box 483, Am. Machinist.

DESIGNING DRAFTSMAN, wide experience special automatic machinery, desires change. Box 994, Am. Machinist.

A-1 MECHANIC, gang-boss or assistant foreman; am 14 years in the business, engines, pumps or electrical machines. Box 2, Am. Machinist.

GENERAL SUPERINTENDENT and manager of large successful concern desires change; nine years in present position. Box 10, Am. Machinist.

FACTORY ENGINEER—Skilled mechanic, expert in organization, tool design, cost reduction and increase of output, desires responsible position. Box 1, Am. Machinist.

SALESMAN, 35 years old, would like a position selling special machinery, machine tools, etc., for a first-class concern; have experience in hydraulics, pipe machines, crushers and printing presses; I am an expert draftsman and have a natural ability in mechanics. Box 19, Am. Machinist.

FACTORY MANAGER or superintendent, by an experienced mechanic; have had 15 years' experience on small interchangeable parts; last five years in charge of production in factory employing 250 hands; understand systematizing; am now employed in position held for last five years and can give best of reference. Box 11, Am. Machinist.

SUPERINTENDENT, now in charge of entire plant, is open to offer from high-grade firm desiring man who can produce results; good executive and organizer; highest references from present and former employers; can qualify on machine tools, steam pumps, auto accessories and general jobbing; correspondence or interview solicited; willing to travel. Box 12, Am. Machinist.

Pennsylvania

DESIGNER, with seven years' experience on typewriters, adding machines and small tools, now employed, desires change. Box 17, Am. Machinist.

FOREMAN—Machine shop; 25 years' practical experience, and technically educated; a first-class man in every particular. Box 15, Am. Machinist.

Rhode Island

FACTORY ENGINEER—Chief draftsman, under 35 years of age, would change for better opportunities; uniformly successful on low-cost production, designing tool work, medium weight electrical, hydraulic machinery, elevators, machine tools, transmission, experimental and automatic machinery; executive, energetic, resourceful. Box 14, Am. Machinist.

Miscellaneous

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Technical Patents. G. M. Sacerdote, M. E. and P. A., 1919 Broadway, N. Y.

Removal—On Mar. 1 will remove to larger quarters—No. 38 Vesey St., New York. Frevert Machinery Co.

"Mechanics for Everybody" makes a limited $1-worth-for-50c. offer; you should see it; sample copy free. Caxton Building, Cleveland, Ohio.

High-grade machine work in quantities for gear cutters, hand turrets, milling machines, etc., wanted. The Seneca Falls Mfg. Co., Seneca Falls, N. Y

For Sale — Bargain, machine shop, small metal work; complete nickel-plating plant and equipment for cabinet work; 12,000 sq.ft. in operation. Machine Co., 1131 South Broadway, St. Louis, Mo.

Largest cutter and drill maker in the United Kingdom, with large works and show rooms, desires few good sole agencies, such as micrometers, center drills, ball bearings and kindred lines. Box 22, Am. Machinist.

German, French and Great Britain manufacturing rights for sale on three valuable inventions, consisting of an attachment for utilizing furnace gases to heat feed water; speed-changing mechanism of new design, and an improved suction pump for heating, ventilating, refrigerating, etc.; fully protected by patents; complete information given upon request. Box 955, Am. Machinist.

For Sale—A prosperous machine metal working and tool plant; equipment complete, including wood-pattern department; excellent location in N. Y. City and a going business; will require about $15,000; will deal with principals only; excellent reason for selling. Earl A. Bowman, 416 Broadway, N. Y. City.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

Talks With Our Readers

By The Sales Manager

Here's a letter from a friend:

AMERICAN MACHINIST,
New York.

Dear Sir—Although I never have known a single member of the editorial force of the AMERICAN MACHINIST personally, yet they have been my best friends for over thirty years, and I congratulate you on the success you have made. One thing struck me forcibly the other day in regard to answering responses to advertisements for help wanted. I have gotten three good positions by answering ads. in the MACHINIST.

The last time I had to advertise for help myself, my employer gave me to understand that it was a matter of his religion to answer every applicant, and explained his reason why in these words: "I was not always in this line of manufacture. I began building farm engines and had a good trade established in Minnesota and the Dakotas. All at once I began to lose it and took a 1000-mile journey to look up the cause and it turned out that a railroad master mechanic whom I did not know was doing his best to put me out of business by 'knocking' my engines. I went to see him and asked the reason why. His answer was:

'When I was in actual distress I answered your advertisement for a foreman. I was brought up in your town and know many there, and referred you to them. I could have done your work for I had done better, but you did not answer my application, and since that time I felt justified in seeing that your machinery was not in the hands of its friends.' That was 20 years ago. I have had to advertise for help many times since, and I have answered every application, and have innumerable friends for doing so."

While I am talking for the good of the order, I would like to see a series of articles in the MACHINIST on the uses of the bench lathe similar to "Uses of the Milling Machine" which appeared several years ago. The bench lathe is an Eastern machine tool and we of the West know but little of it, and I was actually astonished at the work it could do and the ways of doing it in the Elgin watch factory. I bought one and installed it in my garret. It runs by electric power and I have developed many schemes on this simple apparatus, which would never have seen the light of day without it, and there are many who could write a treatise on it, for I never saw an ignorant mechanic running one. Such men as Edward Rivett, Walter Gribben and Geo. F. Ballou could stimulate the inventive faculty of the machinists of the nation and increase the sale of these lathes many times.

I hope that your useful life may be lengthened to a ripe old age, and that you may see some of the good you are doing, and that thousands may testify as I am doing in my humble way that you are doing your share to make the world better.

Very truly yours,
R. L. ADAMS, Supt.,
Menominee Indian Mills,
Neopit, Wis.

* * *

Knocking or boycotting never did anyone any good.

But more and more business concerns are appreciating that it is common business courtesy to acknowledge applications for positions.

* * *

Mr. Adams' second suggestion is a good one.

We wish that more of our good friends would write us what they want, tell us the kind of articles they need.

* * *

Only reliable products can be continuously advertised.